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MISCELLANEOUS

# EXAMPLES IN ARITHMETIC

BY THE

REV. HENRY PIX, M.A.

SECOND MASTER OF WIMBORNE MINSTER GRAMMAR-SCHOOL
LATE SENIOR MATHEMATICAL MASTER OF MARLBOROUGH COLLEGE

THIRD EDITION

LONDON
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THE following collection of Examples in Arithmetic has been drawn up to form a kind of Supplement to the common Treatises on that subject. It is generally found in most Schools, whatever Arithmetic is used, that the master has either himself to invent additional examples or to select them from other works; and it was thought that the present collection might therefore be generally serviceable. The examples are principally taken from Examination Papers set at the Universities, and various Schools. Each Example will be found to contain questions which require a knowledge of *different* rules, so that the student may be always practising himself in general examples, without forgetting one rule as soon as he has learnt another.

Marlborough College: June, 1851.

## NOTE TO THE SECOND EDITION.

In this Edition, errors have been corrected, the answers made more *exact*, and a few Examples, containing more questions, have been added.

Wimborne Minster: Nov. 1857.

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## NOTE TO THE THIRD EDITION.

This Edition has been still further enlarged, and the Examples have been *varied* as much as possible.

Wimborne Minster: May, 1861.

# MISCELLANEOUS EXAMPLES

IN

# ARITHMETIC.

## Ex. 1.

1. Find the sum of £2 13*s.* $5\frac{1}{2}$*d.*; £7 9*s.* $4\frac{1}{4}$*d.*; £5 15*s.* $4\frac{1}{2}$*d.*; £9 17*s.* $6\frac{1}{2}$*d.*; £7 16*s.* 3*d.*; and £5 14*s.* $7\frac{3}{4}$*d.*

2. From 90 thousand and 90 subtract 12345.

3. In $36\frac{5}{9}$ days, 5 hours, 48 minutes, how many minutes?

4. Divide 3587 linear yds. 9 ins. by 27.

5. Add together $3\frac{1}{2}$, $4\frac{1}{3}$, $5\frac{1}{4}$, $\frac{3}{4}$ of $\frac{7}{8}$, and $\frac{1}{2}$ of $\frac{1}{3}$ of $\frac{5}{8}$, and reduce $\frac{2}{3}$ of $\frac{5}{7}+\frac{3}{5}$ of $\frac{4}{9}$ to a simple fraction.

6. What fraction of a crown is 2*s.* 9*d.*; and what decimal of £5 is 3*s.* 6*d.*?

7. Multiply 2·5 by ·0025; and divide 16·9 by ·0013, and by 1·3.

8. Find the value of ·3756 of £1, and reduce $\frac{1}{800}$ to its equivalent simple decimal.

## Ex. 2.

1. Multiply 13 acres, 3 roods, 18 poles, by $\frac{1}{2}$ of $\frac{2}{3}$ of 18.

2. The value of a mark being 13*s.* 4*d.*, and that of a moidore 27*s.*, how many half-crowns are there in 30 marks and 40 moidores together?

3. Find how often £24 11*s.* $6\frac{1}{4}$d. is contained in £8060 18*s.* 10*d.*

4. Multiply ·323756 by ·0038, and divide 21 by ·0035.

5. Prove that the sum of the fractions $1\frac{1}{28}$ and $\frac{1}{1\frac{4}{9}}$ is equal to 5 times their difference.

6. Reduce 6*s.* $3\frac{1}{4}$*d.* to the decimal of a pound, and find the value of ·0324 of a guinea.

7. What is the value of $\left\{ 2\frac{3}{4} + \frac{5}{2} \text{ of } \frac{7}{3\frac{4}{5}} - \frac{1\frac{2}{3}}{2\frac{1}{2}} \right\} + 1\frac{77}{228}$?

8. What will £7 10*s.* a week amount to between the 7th of March and the 4th of July?

## Ex. 3.

1. Find the greatest common measure of 6441 and 10283, and the least common multiple of 209 and 304.

2. A plank is 3 inches broad and 2 thick; what length must be cut off to contain 8 ft. of timber?

3. A service of plate consists of articles weighing respectively 203 oz. 8 dwts. 2 gr.; 408 oz. 9 dwts.; 112 oz. 8 dwts. 3 gr.; 71 oz. 7 dwts.; 73 oz. 5 dwts. 5 gr.; 121 oz. 4 dwts. 6 gr.; 131 oz. 7 dwts.; 105 oz. 5 dwts. 3 gr. What is the weight of the whole?

4. Add together $\frac{3}{7}$ of £15, $\frac{1}{4}$ of $\frac{1}{2\frac{4}{5}}$ of $\frac{4}{5}$ of £1 12*s.* and $\frac{4}{7}$ of 3*d.*; reduce the result to the decimal of £10.

5. Divide ·0068 by 340, 314 by ·0005, and 9·6195 by 1·21.

6. How many coins, each worth 4*s.* 9*d.*, are there in £231 16*s.*?

7. Reduce $\frac{4\frac{4}{15} \text{ of } 2\frac{5}{8}}{5\frac{1}{5} - 4\frac{1}{2}}$ and $\frac{5}{7} \times \left(100 - \frac{200}{3} + \frac{7\frac{1}{3}}{2\frac{1}{4}}\right)$ to simple fractions.

8. If £1 sterling be worth 12 florins, and also worth 25 francs 56 centimes; how many francs and centimes is one florin worth? (100 centimes = 1 franc.)

## Ex. 4.

1. The sum of two numbers is 234, and the greater is 182; what is their product? Add together $\frac{3}{5}$ of £3 7*s.* 6*d.* and $\frac{2}{3}$ of $\frac{1}{4}$ of $4\frac{1}{2}$ guineas.

2. Reduce 253 guineas to crowns, and 76 moidores into pounds.

3. If a wheel of 5 yds. 1 ft. 6 in. in circumference make 64,640 revolutions, what space will it pass over?

4. Find the value of ·07 of £2 10*s.*, and express the result as the decimal of £1.

5. The sides of a rectangular field are 253 yards, and $\frac{1}{4}$ mile, how many acres does it contain?

6. Divide 58546·73 by ·23141; and find what fractional part 15*s.* 9*d.* is of £1 6*s.* 3*d.*

7. What sum will purchase 500 vols. at 2*s.* 3*d.* each, 300 at 5*s.*, 260 at 7*s.* 6*d.*, and 30 at £1 1*s.*? What will this cost be reduced to if a discount of 10 per cent. be allowed?

8. Find the simple fraction which is equal to the difference of $\frac{1}{8}$ of $3\frac{7}{8}$ and $\frac{1}{4}$ of $5\frac{1}{4}$.

## Ex. 5.

1. Find the sum of $3\frac{5}{12}$, $7\frac{1}{2}$, $8\frac{2}{3}$, $4\frac{1}{6}$, and $2\frac{1}{4}$. Divide $11\frac{3}{5}$ by $\frac{4}{3}$ of $3\frac{1}{8}$.

2. Find the least common multiple of 24, 7, 4, 21 and 14; and reduce to a common denominator $\frac{1}{7}$, $\frac{3}{8}$, $\frac{4}{9}$, $\frac{5}{24}$, $\frac{7}{72}$.

3. If 5 oz. of silk can be spun into a thread 2 fur. 20 poles long; what weight of silk would supply a thread sufficient to reach the moon, if the distance be 240,000 miles?

4. Determine the continued product of $\frac{32}{51}$, $\frac{85}{112}$, $\frac{189}{207}$, and $\frac{23}{36}$, expressing the result in its lowest terms.

5. Divide 7·001722 by ·0031, and prove the truth of the result by vulgar fractions.

6. Reduce $\frac{3}{11}$ of 16*s.* $0\frac{1}{2}$*d.* to the fraction of 17*s.* 6*d.*

7. What decimal is equivalent to the sum of ·47, ·013 and $\frac{\cdot 00625}{\cdot 025}$?

8. When the pound sterling is worth 45 pauls 9 baiocchi (Roman) and $25\frac{1}{2}$ francs (French), what is the value of the Napoleon of 20 francs in Roman money? (10 baiocchi = 1 paul.)

## Ex. 6.

1. Add together £$3\frac{5}{8}$, $7\frac{4}{5}$*s.*, and $4\frac{3}{4}$*d.*, and reduce the sum to a fraction of a pound. Subtract $13\frac{3}{7}$ from $15\frac{2}{11}$.

2. Find the product of 3·1416 × 2·89, and of ·7854 × (·02)².

3. How many pieces of coin of 1*s.* 7*d.* each are there in £2827 4*s.*?

4. What is the cost of 847 articles at 3*s.* $4\frac{1}{4}$*d.* each?

5. A room is 13 feet 4 inches long, and 12 feet 6 inches broad; find the expense of carpeting it at 4*s.* 6*d.* per square yard.

6. Reduce $\frac{2}{3}$ of 13*s.* 6*d.* to the decimal of a pound; and add together $\frac{4}{11}$ of $\frac{2}{3}$ of $\frac{1}{2}$, $\frac{7}{8}$ of $\frac{4}{5}$ of $\frac{10}{33}$, and $\frac{2}{5}$ of $1\frac{2}{3}$.

7. Reduce ·90, ·416, ·53, to their equivalent vulgar fractions.

8. Given, that the circumference of a circle is to its diameter as 3·1416 to 1; find (in feet and inches) the circumference of a circle, whose diameter is $22\frac{1}{2}$ ft.

## Ex. 7.

1. How many grains of gold are there in 9 lbs. 11 oz. 13 dwts. 20 gr.?

2. Multiply 22·0001 by 1000·22, and ·201 by ·3.

3. If light travels 192,000 miles per second, how far distant is the sun, if his light is 490 seconds in reaching us? Find the value of $\frac{365}{366}$ to 5 places of decimals, and reduce 3·1416 to a fraction in its lowest terms.

4. If 3 cwt. 17 lbs. cost £4 15*s.* $7\frac{1}{4}$*d.*, what will 16 cwt. 3 qrs. 12 lbs. cost?

5. Reduce into simpler forms $\frac{17\frac{1}{3}}{73}$ and $\frac{7\frac{3}{7}}{40\frac{5}{9}}$ and find the quotient of the latter by the former.

6. What is the cost of paving a court yard, 13 ft. 6 in. by 8 ft. 9 in., at 7*s.* 8*d.* per square yard?

7. Find the difference between $\frac{1}{6}$ of £1 and $\frac{5}{7}$ of 2 guineas.

8. If a piece of cloth be $94\frac{1}{2}$ yards long and $1\frac{1}{8}$ yards broad, how broad is a piece of the same content whose length is $74\frac{2}{3}$ yards?

## Ex. 8.

1. What is the difference between the 11th and 12th parts of 1320? Multiply ·0010102 by $\frac{1}{20}$ of 109·01, and 1·000$\dot{1}$ by ·09081.

2. Find the simple fractions equivalent to $\frac{9}{2}$. $\frac{\frac{9}{2}-1}{2}$. $\frac{\frac{9}{2}-2}{3}$ and $\frac{9}{2}$. $\frac{\frac{9}{2}-1}{2}$. $\frac{\frac{9}{2}-2}{3}$. $\frac{\frac{9}{2}-3}{4}$. $\frac{\frac{9}{2}-4}{5}$. Simplify $3\frac{4}{5}-4\frac{1}{2}+7\frac{2}{7}-\frac{3}{4}$.

3. Reduce $\frac{22}{7}$ to a decimal, and find what fraction 2*s.* $2\frac{3}{4}$*d.* is of 15*s.* $7\frac{1}{4}$*d.*

4. A person's salary is £191 12*s.* 6*d.* per annum; what ought he to receive for 60 days' service?

5. If a tradesman with a capital of £2000 gain £50 in 3 months, what sum will he gain with a capital of £3000 in 7 months?

6. Reduce 24 days 2 hours 8 min. to the fraction of a month of 30 days.

7. In the civil year 97 days are intercalated in 400 years; what is the average length of the year?

8. Find the value of 5 cwt. 3 qrs. 16 lbs. at £3 7*s.* 6*d.* per cwt. by practice.

## Ex. 9.

1. How many half-crowns, sixpences, and fourpences are there in 25 pounds? and how many cwt. in 15680 oz. av.?

2. Reduce 16 cwt. 1 qr. 21 lbs. to the decimal of a ton.

3. What is the tax upon £302 3*s.* 7*d.* when £429 8*s.* 3*d.* is rated at 13*s.* 6*d.*?

4. Find the value of $\frac{(2+\frac{1}{5})+(3+\frac{1}{7})}{(\frac{1}{2}-\frac{1}{3})\times(4-3\frac{3}{7})}$. Reduce $3\frac{1}{2}$ of £1 3*s.* 4*d.* to the fraction of £5.

5. If a single article cost 3*s.* 7*d.*, how many dozens may be bought for £86 10*s.*?

6. Required the vulgar fraction which is equivalent to ·41$\dot{6}$, and its square root to 6 decimal places.

7. A room is $29\frac{1}{2}$ feet long, and $14\frac{1}{4}$ feet wide; what will be the expense of carpeting it, at 3*s.* 6*d.* per yard, the carpeting being $\frac{5}{8}$ of a yard wide?

8. What is the simple interest of £236 6*s.* 8*d.* for $2\frac{1}{2}$ years, allowing 3 per cent. per annum?

## Ex. 10.

1. A privateer, running at the rate of 10 miles an hour, discovers a ship 18 miles off, running away 8 miles an hour; how long will the chase last? Multiply 63·65 by $\frac{1}{5}$ of ·045, and divide 20 by ·018.

2. Determine which is the greater $\frac{3}{5}$ or $\frac{5}{7}$; the square root of 2 or $\frac{7}{5}$; and $\dot{3}$ or $\frac{10}{21}$.

3. Express in the decimal notation the value of $8{\cdot}0625 - 6\frac{1}{25} - {\cdot}00375 + 1{\cdot}09236 - \frac{25879}{10000}$.

4. How many revolutions will the wheel of a carriage, 4 ft. 7 in. in circumference make in 2 mi. 4 fur.?

5. Bought 13 cwt. 1 qr. 8 lbs. of tea, at £1 11*s.* 9*d.* per qr., what does the whole cost?

6. What is the discount upon £500, due 15 months hence, at the rate of 4 per cent. simple interest?

7. If the wages of 8 persons for 21 weeks be £92, what will be the wages of 14 persons for 33 weeks?

8. How many cubic feet are contained in a beam 20 ft. 4 in. long, 1 ft. 5 in. broad, and 10 in. thick?

## Ex. 11.

1. Reduce to a simple fraction $\frac{4\frac{1}{3} \times 4\frac{1}{8} \times 4\frac{1}{3} - 1}{4\frac{1}{3} \times 4\frac{1}{3} - 1}$. Divide 1 by $3\frac{3}{5}$.

2. Find the square root of 16·4025, and the cube root of 50653.

3. What decimal of a pound is ·45 of a guinea, and how much is ·255 of a day? Multiply 12*s.* 6*d.* by 2·74.

4. In 3000 fourpences, how many half-crowns and half-guineas?

5. Find the weight in lbs. of 3 doz. spoons, each weighing 2 oz. 3 dwts.

6. The 4 per cents. being at $82\frac{1}{8}$, what must be given for £1000 stock?

7. The property in a town is assessed at £60,000; what must be the rate in the pound in order that £2500 may be raised?

8. If $3\frac{3}{4}$ shares be worth £27 10*s.*, what are $4\frac{5}{8}$ shares worth?

## Ex. 12.

1. What number subtracted from 510 thousand leaves 312? Which is the greater ·0231 of a guinea, or ·19 of a half-crown?

2. Add together $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{7}{8}$, and $\frac{1}{5}$ of $\frac{2}{3}$ of $\frac{15}{8}$, and $\frac{1}{4}$. Reduce $\frac{1}{2} \times (6\frac{1}{2} + 2\frac{2}{3} - 3)$ to a decimal.

3. What is the value of $\frac{7}{9}$ of a pound sterling? and reduce 11 cwt. 1 qr. 6 lbs. to the fraction of a ton.

4. A person after paying 7*d.* in the pound for income-tax has £563 1*s.* 8*d.* remaining, what is his income?

5. How many square feet and square inches remain out of 313 square feet of carpeting, after covering a room 16 ft. 9 in. long, and 12 ft. 11 in. broad? what is the price of the required carpet at 3*s.* 6*d.* a yard?

6. What is the cost of 3 r. 17 p. $15\frac{1}{8}$ y., at £125 per acre?

7. If when malt costs 63*s.* a quarter, the price of a quart of ale be $4\frac{1}{2}$*d.*, what should its price be when malt is at 66*s.* 6*d.* per quarter?

8. A person by disposing of goods for £182 loses at the rate of 9 per cent.: what ought they to have been sold for, to realise a profit of 7 per cent.?

## Ex. 13.

1. How many fifties are there in 510 millions? What is the total cost of a million of postage labels?

2. Add $\frac{1}{5}$ of $\frac{2}{5}$ of 4*s.* $4\frac{1}{2}$*d.* to $\frac{3}{8}$ of $\frac{1}{7}$ of a guinea; and multiply $\frac{1}{2}$ of $2\frac{1}{4}$ of $3\frac{1}{3}$ of 9·05 by ·0105. Divide 5462 by 347 to 4 decimal places.

3. A book contains 215 pages, 55 lines in a page, and 45 letters in a line; how many letters are there?

4. Find the amount of £375 in two years, at $4\frac{1}{2}$ per cent. compound interest.

5. A person invests £5000 in the Dutch $2\frac{1}{2}$ per cents. at $48\frac{1}{2}$; what is his annual income?

6. A bankrupt owes £900 to his three creditors; and his whole property amounts to £675; the claims of two of his creditors are £125 and £375 respectively; what sum will the remaining creditor receive for his dividend?

7. Find by cross multiplication the content of a floor whose length is 22 ft. $8\frac{3}{4}$ in. and breadth 16 ft. $7\frac{1}{2}$ in.

8. If 1100 men make 10 miles of railroad in 3 months, how long will it take 2750 men to make 75 miles?

## Ex. 14.

1. Reduce $£\frac{\cdot 012}{625}$ to the fraction of a farthing, and divide £·12 by ·000625. Find the greatest common measure of 41,736 and 6549.

2. Reduce to their simplest forms $1\frac{1}{3}+(\frac{6}{8}\times\frac{41}{34})+\frac{4}{5\frac{1}{10}}$, and $(\frac{5}{7}\times\frac{2}{5}\times 13\frac{1}{2})\div(\frac{1}{5}\times\frac{3}{7}+54)$, and to their lowest terms $\frac{1197}{2471}$, and $\frac{8398}{29393}$.

3. Find the price of 3 cwt. 2 qrs. 10 lbs. at 2*s.* $4\frac{3}{4}$*d.* per lb.

4. A field is 121 yards long, and 86 yards broad; what will be its value at £80 per acre?

5. What is the present value of £918 due four years hence, interest being calculated at the rate of 5 per cent. per annum?

6. A person bought 180 gallons of wine for £125; find the quantity of water to be added that he may retail it at 12*s.* 6*d.* a gallon.

7. A., B., and C., do a piece of work separately in 3, 4, and 5 days; in what time will they perform it jointly?

8. Which is the most advantageous stock to invest in; the 3 per cents. at $89\frac{1}{2}$, or the $3\frac{1}{2}$ per cents. at $98\frac{1}{2}$?

## Ex. 15.

1. Multiply ·0005 by $\frac{\cdot 016}{20}$; and reduce $\frac{1}{25}$ of $\frac{1}{6}$ of $7\frac{1}{2}$ to a decimal.

2. If the nett income of an estate, after paying all taxes, be £534 15*s.*, and the gross income £570 8*s.*; how much in the pound did the taxes amount to?

3. Extract the square roots of 822649, 2·7889 and 5.

4. How much in length that is $13\frac{1}{2}$ poles in breadth must be taken to contain an acre?

5. If £1 sterling be worth 25 francs 60 centimes; and also worth 6 thalers 20 silver groschen; how many francs and centimes is a thaler worth? (1 thaler = 30 silver groschen.)

6. The length of a metre is 39·37 inches; find the number of solid inches in a cube whose side is a metre.

7. If 858 men in 6 months consume 234 quarters of wheat, how many quarters will be required for the consumption of 979 men for three months and a half?

8. What clear income is derived from an estate of £800 a year, after paying $\frac{1}{9}$th of this sum for expenses, and $4\frac{1}{2}$ per cent. on a mortgage of £2000?

## Ex. 16.

1. Reduce to their simplest forms $(\frac{2}{19}+\frac{1}{3})\div(3-\frac{1}{3})\times(\frac{1}{3}+\frac{1}{5})$, and $\frac{18}{17}\times(1-\frac{64}{81})+\frac{2}{11}\times\frac{1}{6}\times(\frac{1}{2}+\frac{5}{12})$.

2. A piece of money is worth 16*s.* 3*d.*; how many guineas are there in 253 such pieces?

3. Find the value of the decimal £15·275; and reduce 5 yds. 1. ft. 6. in. to the fraction of a mile.

4. What is the cost of 11 cwt. 3 qrs. at £4 13*s.* 4*d.* per ton?

5. If $\frac{1}{4}$ of a yard cost $\frac{2}{3}$ of a pound, what will $\frac{3}{5}$ of an English ell cost?

6. A person purchases £1000 3 per cent. consols at $96\frac{7}{8}$, and sells out again when they have sunk to $82\frac{3}{4}$; how much does he lose by the transaction?

7. If 25 yards of butter cost 30*s.*, what must it be sold at per foot to gain 5*s.* by the whole? Bought 236 gal. for £111 6*s.* 8*d.*; what profit will be made by selling it at 8*s.* 6*d.* per 3 qts.?

8. A legacy of £1000 is left to three individuals in the proportion of 1, 2 and 3; find the sums received by each after deducting the legacy duty of £10 per cent.

## Ex. 17.

1. The less of two numbers is 187, and their difference 34; what is the square of their product? Divide ·00683468 by 2·0102, and 34 by ·17. Find the value of $(\frac{2}{5})^2$ of ·001.

2. Find the value of ·972916 of £1, and of ·0138 of 3·5 moidores.

3. Simplify $\frac{3\frac{1}{13}}{19\frac{2}{43}}$ and $\cfrac{2}{3+\cfrac{4}{5+\cfrac{6}{7}}}$.

4. A carriage load is found to weigh 1 ton 3 cwt. 1 qr., and it consists of 215 equal packages; what is the weight of each?

5. An area measuring 30 ft. 6 in. by 8 ft. 9 in. is to be paved. What will it cost at the rate of 4*s.* 8*d.* per square foot?

6. What is the price of £4500 in the 3 per cents. when they are at 90? What real interest does the purchaser get for his money?

7. A. can mow a field in 2 hrs, which B. can mow in 4 hrs., and B. and C. together in $1\frac{1}{2}$ hr.; in what time will they mow it working all three together?

8. Find the length of the side of a cube which contains 8060150125 solid inches.

## Ex. 18.

1. If a person's annual income be £500, what is his income per day?

2. Add $\frac{5}{7}$ of $\frac{1}{4}$ of 6*s.* 5*d.* to $\frac{1}{8}$ of $\frac{2}{5}$ of half a crown, and reduce 5*s.* to the decimal of 13*s.* 4*d.* What is ·23 of a day?

3. Explain the rule for the addition of decimals; add together $\frac{3}{8}$ and ·061; subtract ·003 from ·02; and divide ·0672 by ·006.

4. The English shilling weighs 3 dwts. 15 grs., of which 3 parts out of 40 are alloy, and the rest pure silver; what weight of pure silver is there in 20 shillings?

5. Find the square root of $2\frac{457}{4096}$, and the cube root of 373248.

6. Find the amount of discount if £250 15*s.* is paid 9 months before it is due, and 5 per cent. per annum is allowed.

7. A person whose debts are £1500, pays £950, how much is that in the pound? A creditor receiving £51 for his debt, finds that he is paid 12*s.* 9*d.* in the pound; what is his debt?

8. A tradesman marks his goods with two prices, one for ready money, and the other for one year's credit, allowing discount at 5 per cent.; if the credit price be marked at £2 9*s.*, what ought to be the cash price?

## Ex. 19.

1. What amount would be obtained from 245 subscribers, each contributing a guinea, a crown, a half-crown, a shilling, and a sixpence? Reduce to their simplest forms $\frac{1573}{689}$; $\frac{7}{8}-\frac{5}{8}$, and $\frac{2}{5}+\frac{3}{8}+\frac{7}{12}$.

2. Find the cost of carpeting a room 12 ft. 4 in. by 16 ft. 3 in., at 1·5*s.* per square foot.

3. What is the price of 53 cwt. 3 qrs. 7 lbs. at £73 15*s.* 6*d.* per cwt.?

4. If 16 horses eat 3 bushels in 10 days, how long will 63 bushels keep 56 horses?

5. What will £2153 10*s.* bank stock cost at $188\frac{7}{8}$ per hundred; half-a-crown a hundred being paid in addition for commission?

6. A. was the owner of $\frac{4}{17}$ of a vessel, and sold $\frac{3}{11}$ of $\frac{2}{5}$ of his share for $£\frac{400}{33}$; what was the value of $\frac{1\frac{2}{5}}{4\frac{1}{4}}$ of $\frac{2}{5}$ of it?

7. If a parcel of goods, bought for £18, be sold 4 months afterwards for £25, what is the gain per cent. per annum?

8. What is the value at 16 years of age of a legacy of £1000 payable at 21, allowing simple interest at 4 per cent.?

## Ex. 20.

1. Divide the product of 12·45 and 8·25 by 0·005. Multiply 34 acres 2 roods 13 perches by ·03, and $17\frac{2}{5}$ by $\frac{6}{7}$ of $3\frac{1}{2}$.

2. In 350 seven shilling pieces, how many half guineas are there, and how many pounds?

3. What is the income corresponding to an income-tax of £13 2*s.* 6*d.*, at the rate of 7*d.* in the pound?

4. Required the amount of £320 15*s.* for 2 years and 35 days at $4\frac{3}{4}$ per cent. per annum, simple interest?

5. If 4 cwt. 1 qr. 7 lbs. cost £5 per cwt., what will be the cost per pound when the cost of the whole has been reduced by £5 9*s.* 3*d*?

6. The French franc is divided into 100 centimes, and the Frankfort florin into 60 kreutzers. When the pound sterling is worth 25·50 francs

at Paris, and 11 fl. 54 kr. at Frankfort, what is the worth of the Napoleon of 20 francs in florins and kreutzers?

7. If 4 men earn £15 in 20 days, how many men will earn 10 guineas in 7 days?

8. A cistern is filled by a tap A in $\frac{1}{4}$ hr., and by a tap B in 25 minutes; and it is emptied by a tap C in 30 minutes; in what time will it be filled if the three taps be all open together?

## Ex. 21.

1. How many feet long is a wall measuring 1550 links? Subtract $\frac{1}{2}$ of $\frac{5}{6}$ from $\frac{2}{3}$ of $\frac{7}{11}$, and multiply the result by $\frac{3}{7}$ of $\frac{5}{8}$.

2. Divide £26 4*s.* 2*d.* into two parts, which shall be to each other as 7 : 13.

3. If 43 cwt. 3 qrs. 14 lbs. of sugar cost £187 4*s.*, how much may be bought for £13 17*s.* 4*d.*?

4. Show that $\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}} = 10$ nearly, and that 7 : 8 is greater than 5 : 6.

5. A cubic foot of wood weighing 12 lbs., what is the weight of a beam whose length, width, and depth are 24, $2\frac{3}{4}$, and $2\frac{1}{2}$ feet? Find also its value at 3*s.* 4*d.* per cubic foot.

6. A person possessing $\frac{3}{14}$ of an estate sold $\frac{2}{7}$ of $\frac{1}{3\frac{1}{5}}$ of his share for £120$\frac{5}{8}$; what would $\frac{1}{5}$ of $\frac{3}{16}$ of the estate sell for at the same rate?

7. The dividends on a certain amount of 3 per cent. stock accumulated in 13 years to £3081. How much stock was there, and what will it be worth when this fund is sold at 79$\frac{7}{8}$ per cent.?

8. If £15 10*s.* be paid on the 1st of January, and the same sum on every 10th day after, how much will be paid during the year? How many days of payment will fall on the same day of the week as the first?

## Ex. 22.

1. Divide $\frac{2}{3}$ of $\frac{9}{10}$ by $3\frac{3}{14}$. What part of three guineas is half-a-crown? How much is $\frac{3}{20}$ of a day?

2. Simplify 1·26 of $66\frac{2}{3}$ + $5\frac{1}{5}$ of 1·0375; and $3\frac{5}{8}$ of ·031 − ·0011 of $7\frac{1}{4}$.

3. A factor bought 56 pieces of stuff for £1569 17*s.* 4*d.*, at 4*s.* 10*d.* per yard, how many yards in each piece?

4. If a bankrupt pay 3*s.* 4*d.* in the pound, what will be received on a debt of £3678 16*s.*? By how much will this be reduced if 1 per cent. on the amount realised be deducted?

5. Find the difference between the interest and discount of £500 for two years, allowing $4\frac{1}{2}$ per cent.

6. If 12 men build 24 roods of wall in 30 days, working 8 hours a day, how many hours per day must 18 men work to build 72 roods in 40 days?

7. A man sells an article for 5*s.* and gains 20 per cent., what was its prime cost?

8. A watch which is 4 m. $8\frac{9}{32}''$ too fast at half-past nine A. M. on Tuesday, loses 2 m. 45″ daily; what will be the time indicated by the watch at a quarter past five P. M. on the following Friday?

## Ex. 23.

1. Find the value of $\frac{1}{2}$ {£3251 11*s.* 7*d.* − £2615 13*s.* 9*d.*} − {£69 17*s.* $5\frac{3}{4}$*d.*} ÷ 9. Reduce 1 R. 3 P. $9\frac{1}{4}$ Y. to square inches.

2. A rouble is worth $1\frac{51}{80}$ florin, and a pound is worth $10\frac{3}{4}$ florins. What is the value of a rouble?

3. Find the value of £·634375 + ·025 of 25*s.* + ·31$\dot{6}$ of 30*s.*

4. Distinguish between a rule of three direct and a rule of three inverse. If a person travelling $13\frac{3}{4}$ hours a day perform a journey of $27\frac{5}{8}$ days, in what length of time will he perform the same, if he travel $10\frac{9}{7}$ hours a day?

5. Extract the square root of $1\frac{56}{169}$, and the cube root of 1953125.

6. How many bricks will be required to build a wall 20 yards long, $7\frac{1}{2}$ feet high, and 15 inches thick, supposing a brick to be 9 in. long, $3\frac{1}{2}$ wide, and $2\frac{1}{2}$ deep?

7. Calculate the simple interest on 500 guineas for four months, and the compound interest on the same for $1\frac{1}{2}$ years, at 4 per cent. per annum.

8. A cistern of water, whose capacity is 20 gallons, is supplied by two spouts; one of which, alone, will fill it in 2 hours; the other, in 3 hours. It has also a discharging spout, which would empty it alone in 4 hours. Supposing the cistern empty, and all the spouts open, in what time will it be just filled?

## Ex. 24.

1. Divide 12·35 by 1·5, ·1 by ·2, ·35 by 35, and multiply the last two quotients together. What decimal of a day is 23 h. 15 m. 6 s.?

2. Find the rent of 22 acres, 3 roods, 27 perches, at £2 3*s.* 8*d.* per acre.

3. Add together $2\frac{1}{3}$ and $17\frac{7}{12}$, and subtract $\frac{2}{3}$ of $\frac{119}{18}$ from the sum.

4. How many revolutions will a carriage wheel, the diameter of which is 3 ft., make in a mile, the diameter of a circle being $\frac{1}{3{\cdot}1416}$ of the circumference?

5. The 3 per cent. consols are at $94\frac{1}{8}$; what annual income is obtained by the investment of £3500, $\frac{1}{8}$ per cent. upon the stock bought being paid

for commission? If consols were to rise to 97, what would be gained by selling out?

6. Determine the volume of a cube, one of whose edges is 2 ft. 7 in.

7. Bought goods at $6\frac{1}{2}d.$ per lb., and sold them at £4 10*s.* per cwt. What is the gain or loss per cwt.?

8. A. B. and C. are in partnership; A.'s capital was £2000, B.'s £2500, and C.'s £3000. A profit of £1000 is to be divided among them, what is the share of each?

## Ex. 25.

1. If the upper line in a subtraction sum be three millions one thousand and two, and the remainder twelve hundred and twelve, what is the lower line? Add $\frac{3}{5}$ of a crown to ·4 of a shilling, and reduce the sum to the decimal and fraction of a pound.

2. If $1\frac{1}{2}$ lb. cost 4*d.*, what is the price of 2 tons 8 cwt.?

3. Simplify $(\frac{1}{2}+\frac{1}{3}+\frac{1}{4})\div\left(\frac{1}{2\frac{1}{2}}+\frac{1}{3\frac{1}{2}}+\frac{1}{4\frac{1}{2}}\right)-\frac{13}{24}$ of $\frac{576}{264}$.

4. A floor is to be carpeted, whose length is 41 ft. 11 in., and its width 22 ft. 3 in. 9 pts. Give the number of square feet and inches contained in the whole, and the price of carpeting at 3*s.* per square yard.

5. The rents of a parish amount to £2360 10*s.*, and a rate is granted of £160 16*s.* 8*d.* What portion must be paid by a person whose rental is £590 2*s.* 6*d.*?

6. Find the discount on £237 10*s.* due four months hence, at 4 per cent. simple interest. What would be the amount of the error in the above case, if interest were taken instead of discount, and in whose favour would the error be?

7. If a workman earns £17 6*s.* in $102\frac{1}{2}$ days, how long will he be in earning 50 guineas?

8. Extract the square root of ·016, and find the hypothenuse of a triangle, whose base and perpendicular are respectively 30 and 40.

## Ex. 26.

1. The product of two numbers is 54,756; one of them is 234; what is the other? Find the value of $\cdot00711009 \div 103 \div (49\cdot14290404)^{\frac{1}{4}}$.

2. How much will a person who has £900 a year have to pay under an income tax of 7*d.* in the pound?

3. Reduce to its simplest form the expression $\left\{\frac{3\frac{1}{2}}{7}+\frac{2}{10\frac{1}{2}}-\frac{5}{18}\text{ of }\frac{4}{7}\right\} \times 1\frac{3}{4}$; and multiply the sum of 1·05 and 2·303 by 100.

4. What quantity of land would be required for a road 50 miles long and 22 yards broad? and what would it cost at £55 an acre?

5. If 4 men can do a piece of work in 5 hours, and 6 boys require 7 hours to do it in, find how long 5 men and 5 boys, working together, would be about it.

6. A carpenter has a board 18 inches long and 8 broad; if he make it into a square, what will be its side?

7. What income is derived from £14,000 3 per cent. stock, and what from as much 3 per cent. stock as £14,000 will purchase at 88 per cent.?

8. A man sells a horse for £24 12*s.* and loses £17 16*s.* per cent. on what the horse cost him, what was the original cost? At what price must a man sell a horse, bought for £25, to gain $4\frac{1}{2}$ per cent.?

## Ex. 27.

1. State the rule for finding the greatest common measure of two numbers. Reduce 2*s.* 9*d.* to the decimal of a pound, and find the value of ·0175 of a ton.

2. Simplify $\frac{1}{10}\{43{\cdot}675 + 6{\cdot}33\} + {\cdot}15351 \div 3{\cdot}57$. Express as a fraction of £5 the difference between $£7\frac{4}{5}$ and $£7 \times \frac{4}{5}$.

3. Find, in inches, the area of a floor 18 ft. 3 in. long, and 14 ft. 9 in. broad.

4. There are 1760 yards in a mile, and 4840 square yards in an acre. How many acres are there in a square mile?

5. If the interest on an exchequer bill be reduced from 2*d.* per cent. a day to $1\frac{3}{4}d.$ per cent. a day, how much is the annual interest diminished?

6. If 1 lb. cost ·5625 of 2*s.*, what is the value of ·75 of 1 cwt.?

7. A pipe of wine costs £98, and contains 65 dozen and 4 bottles, what does it cost a bottle? How much would the price be increased by expenses amounting to 15 per cent. on the first cost?

8. At what time between 2 and 3 o'clock are the hour and minute hands of a clock at right angles to one another?

## Ex. 28.

1. If a crew receive £30492 in a year, and each man receives £3 a month, what is the number of the crew? Subtract $\frac{1}{7}$ of 3*s.* $2\frac{1}{2}d.$ from $\frac{7}{5}$ of $\frac{3}{4}$ of a crown; and reduce $\frac{33}{132}$ to a decimal form.

2. Find the value of $\frac{494}{221} - \frac{4}{17}$, and $21{\cdot}32 \times 10{\cdot}0103 - {\cdot}0048 \div 1{\cdot}2$.

3. Find by practice the value of $7254\frac{1}{2}$ chests of tea at £25 2*s.* 3*d.* per chest.

4. If a person's estate be worth £1384 16*s.* a year, and the land tax be assessed at 2*s.* $9\frac{1}{2}d.$ per pound, what is his annual income?

5. If 2 gallons of spirits be sold at 18*s.* 6*d.* per gallon, 3 at 19*s.* 10*d.*, and 5 at £1 ; what is the average value per gallon?

6. A straight line is 3 ft. 4 ins. long; divide it into two parts, one of which shall be to the other as 5 : 7.

7. On the price of 25 vols. bought at 3*s.* a vol. the bidder is allowed 5 per cent., on that of 12 others, at 5*s.* 3*d.* a vol., $7\frac{1}{2}$ per cent.; $2\frac{1}{2}$ per cent. of the auction duty is also paid by the purchaser, what will the books cost?

8. If a vessel sails 500 miles in 2 days $18\frac{1}{2}$ hours, how far will she sail between May 20 at noon, and 8 o'clock on the morning of July 10?

## Ex. 29.

1. Find the value of £·1225, and reduce 1 ft. $1\frac{1}{2}$ inches to the decimal of a yard. Show that $\frac{7}{8}$ of $\frac{3}{4}+3\frac{1}{7}$ of $\frac{9}{16}$ of $\frac{3}{4}=2-\frac{1}{56}$.

2. What sum of money must be divided among 38 men, so that each may receive £14 6*s.* $8\frac{1}{2}$*d.*?

3. Extract the square root of ·567009 and of ·004 and $1\frac{3}{8}$ to 4 places of decimals.

4. Explain the meaning of the terms *interest, discount, present worth.* Find the present worth of £1250 due at the end of 3 months, allowing $3\frac{1}{2}$ per cent. per annum.

5. If I buy 50 shares at £$22\frac{1}{8}$ per share, and sell them at $19\frac{1}{4}$, how much do I lose? And if I invest the produce of the latter sale in shares at 61, and sell them at $73\frac{1}{2}$, how much do I gain by the whole transaction?

6. Find the cost of papering a wall 14 feet 3 inches long, and 11 feet 11 inches high, at 1*s.* 4*d.* the square foot.

7. If 10 cannon, which fire 3 rounds in 5 minutes, kill 270 men in an hour and a half, how many cannon, which fire 5 rounds in 6 minutes, will kill 500 men in one hour, at the same rate?

8. At what rate per cent. will a person receive interest who invests his capital in the 3 per cents. at 91?

## Ex. 30.

1. A. was born when B. was 18 years old, how old will A. be when B. is 41, and what will be the age of B. when A. is 72?

2. Reduce 3*d.* and ·13*d.* to the decimal of a pound, and divide $\frac{5}{8}$ of 50 by $4\frac{1}{3}$. How much is ·5 of £1 11*s.* 4*d.*?

3. Reduce to its simplest form $(\frac{1}{24})\times(2)^3\times(3)^2$; and find the value of £$\frac{1}{7}+\frac{2}{5}$*s.*$+\frac{5}{12}$*d.*

4. What is the discount of £63 10*s.* due 15 months hence, interest being reckoned at $4\frac{1}{2}$ per cent. per annum?

5. A person transfers £3000 stock from the 3 per cent. consols at $89\frac{3}{8}$ to the reduced $3\frac{1}{2}$ per cents. at $98\frac{1}{4}$; what is the alteration in his income?

6. If 12 men can reap a field in 4 days, in what time can the same work be performed by 32 men?

7. The bottom of a cistern contains 16 square feet 18 ins., how deep must it be to contain 164 gallons, when 1 gallon$=277\frac{1}{4}$ cubic inches?

8. If 300 marks be allowed to a paper of 12 questions, and to 8 of them the average is given, and to the rest they are given in the proportion of 4, 5, 7, 9, find the number allotted to each.

## Ex. 31.

1. Divide $4362+9081$ by $5806-1325$. Add $\frac{1}{37}$ of £63 9*s.* $6\frac{3}{4}$*d.* $+\frac{3}{5}$ of $\frac{7}{4}$ of £1 to $\frac{1}{3}$ of $\frac{5}{2}$ of 7*s.* 6*d.*

2. Find the cost of 435 lb. 3 oz. of tea at 5*s.* 4*d.* per pound.

3. Find the value of ·785 of a year, consisting of $365\frac{1}{4}$ days; and reduce $\cdot 5\dot{3}$ and $\cdot 00\dot{9}\dot{8}\dot{7}$ to vulgar fractions.

4. If I spend £76 5*s.* weekly; what must be my daily income, that at the end of 15 years I may lay by £3761 5*s.*?

5. A person lays by £230 at the end of each year, and employs the money at $3\frac{1}{2}$ per cent. compound interest; what will he be worth at the end of three years?

6. A. can do a piece of work in 5 days, B. in 6, and C. in 7; how much of it can they jointly do in 2 days?

7. Supposing 15 bushels of barley at 5*s.* per bushel, and 12 bushels of rye at 3*s.* 6*d.* per bushel, were mixed together, how must the compound be sold per bushel without loss or gain?

8. Three men, A. B. C., run round a circle; A. can run round it in 5 minutes, B. in 6, and C. in $7\frac{1}{2}$; if they start from the same point, how long will they run, before they are all together again?

## Ex. 32.

1. Write down one billion fifty millions and fifteen. What part of £20 is half a guinea? and how much is $\frac{16}{16}$ of a cwt.?

2. Multiply together $\frac{3}{4}$, $\frac{5}{7}$, $7\frac{1}{5}$, $\frac{2}{3}$ of $3\frac{3}{8}$; and divide $\frac{4}{7}$ of $\frac{2}{3}$ by $\frac{8}{9}$ of $\frac{1}{7}$.

3. Reduce $\frac{11}{62\frac{1}{2}}$ and $6\frac{3}{4}$ of $\frac{1}{25}+\frac{17}{25}$ to decimals.

4. If the carriage of 5 cwt. 7 lbs. for 84 miles cost £3 18*s.* 4*d.*, what will it cost to have 21 cwt. 1 qr. 14 lbs. carried the same distance?

5. Find the square root of $\frac{15}{21}$ to 3 places of decimals, and the cube root of ·000008869743, and 5.

6. A cistern 6 feet deep, contains 720,000 cubic inches, and its base is a square; find a side of the square.

7. If by selling goods at 2*s.* 3*d.* per lb. I clear cent. per cent., what shall I clear per cent. by selling them for 9 guineas per cwt.?

8. If 1 lb. of tea be worth 72 oranges, and 48 oranges are worth 64 lemons; what is the price of 1 lb. of tea when a lemon is worth a penny?

## Ex. 33.

1. How much does 635 amount to, when repeated 999 times? Required the difference between $\frac{1}{13}$ of £1, and $\frac{1}{14}$ of a guinea.

2. Find the value of $2{\cdot}7 \times {\cdot}27 \times {\cdot}027 \times 270$.

3. Show that $\frac{8}{\sqrt{2}} = 5{\cdot}6568$ nearly, and find the value of $\dot{9}72916\dot{}$ of £1.

4. Find the value of 37 cwt. 2 qrs. 3 lbs. at £3 7*s.* 10*d.* per cwt.

5. The length, breadth, and thickness of a piece of timber are respectively 94 ft. 6 in., 5 ft. and 2 ft. 5 in.; how many solid feet and inches does it contain? What is its price at $8\frac{3}{4}$*d.* per solid foot?

6. A person buys tea at 6*s.* a lb., and also some at 4*s.* a lb. In what proportions must he mix them, so that selling his tea at 5*s.* 3*d.* a lb. he may gain 20 per cent. on each lb. sold?

7. What is the difference between interest and discount? Which of the two is the greater, and on what account? Required the present worth of £35 due 4 months hence at $4\frac{1}{2}$ per cent.

8. A watch which is 10 minutes too fast at 12 o'clock on Monday, gains 3 min. 10 sec. per day; what will be the time by the watch at a quarter past ten in the morning of the following Saturday?

## Ex. 34.

1. How many allotments, each 2 R. 25 P. are contained in $47\frac{1}{4}$ A? What is the sum of $\frac{4}{7}$ of a cwt., $8\frac{5}{6}$ lb., and $3\frac{9}{10}$ oz.?

2. What fractions of a pound are $\frac{3}{14}$ of a penny, and $\frac{15}{56}$ of a guinea respectively?

3. Reduce $\frac{119}{330}$ to the form of a decimal, and find the value of ·0191919. . . . . .

4. Find the income produced by £12600 stock in the 3 per cents.; and its value sterling, stocks being at 95.

5. The cost of a cubic mass of metal is £8534 18*s.* 7*d.* at £4 3*s.* 4*d.* a cubic inch; what is the area of one side of the mass?

6. Find a number which shall have to 4 the same ratio that 3·75 has to 3.

7. A. and B. have gained by trading £182; A. put into the stock £300 and B. £400; what is each person's share of the profit?

8. A. met two beggars, B. and C., and having $\frac{3\frac{7}{11}}{4\frac{2}{7}}$ of $\frac{10\frac{5}{7}}{7\frac{1}{2}}$ of $\frac{77}{540}$ of a moidore in his pocket, gave $\frac{1}{7}$ of $\frac{3}{4}$ of it to B., and $\frac{3}{5}$ of the remainder to C.; what did each receive?

## Ex. 35.

1. Divide £45 14*s.* $0\frac{3}{4}$*d.* by 2*s.* $7\frac{1}{4}$*d.*; and find how many dollars at 4*s.* 2*d.* there are in £20.

2. Extract the square root of ·05368489 and the fourth root of ·0081. Express as decimals $\frac{3927}{1250}$ and $\frac{7}{13}$.

3. What is the expense of carpeting a room 15 ft. 6 in. by 12 ft. 9 in.; the price of the carpet being 7*s.* 8*d.* per yard, and the width of the carpet 24 in.?

4. Required the compound interest of £130 in 3 years at 4 per cent. per annum.

5. In 16914 francs 19 centimes, how many pounds sterling; the exchange being at 24 francs per pound?

6. If 36 oxen eat 216 acres in 1 year, and a sheep eat half as much as an ox, how long will 45 oxen and 136 sheep be eating 17628 acres together?

7. The true length of a year being 365·24224 days, find what the error amounts to by the common reckoning in four centuries.

8. A passenger-train which runs at the rate of 36 miles an hour leaves a given station two hours after a luggage-train, whose rate is 30 miles, and overtakes it at the railway terminus; required the distance between the station and the terminus, and the time which elapses during the passage of each train between them.

## Ex. 36.

1. Find the value of $(1302)^2 + (324)^3$. Simplify $\frac{3}{14}$ of $\frac{4\frac{5}{9}}{6\frac{1}{8}}$ of $\frac{6\frac{8}{11}}{11\frac{5}{7}}$.

2. Subtract $\frac{3}{4}$ of 2*s.* 6*d.* from $\frac{8}{9}$ of a guinea; and reduce $33\frac{1}{4}$ of 3 qrs. to the fraction of $3\frac{3}{4}$ tons.

3. Find the value of $2{\cdot}5 - 6{\cdot}002 + \frac{3}{{\cdot}04}$; and divide 60 by ·00048.

4. What will 1 ton 11 cwt. 2 qrs. 14 lbs. cost at £1 13*s.* 7*d.* per cwt.

5. What incomes respectively will £5000 of $3\frac{1}{2}$ per cent. stock, and £5000 invested in $3\frac{1}{2}$ per cent. stock, at $102\frac{2}{3}$ produce?

6. If £400 is due at the end of 2 years, and 2100 at the end of 8 years; what is the equated time for one payment, reckoning 5 per cent. simple interest?

7. What sum must be divided among 18 men and 9 women, so that each man may have £1 3*s.* 6*d.*, and each woman $\frac{2}{3}$ of that sum?

8. A man buys a flock of sheep consisting of 117 for £108; he loses 3, and finds 18 others in such bad condition, that he is obliged to sell them for 4 shillings a piece less than they cost him; at how much per head must he sell the remainder, in order that he may, on the whole, gain £5 by the transaction?

## Ex. 37.

1. Write down as decimals $\frac{18}{10000}$ and $\frac{4}{100000}$, and add them together. What are the values of the decimals ·66... and ·36565... ?

2. Reduce $1\frac{42}{65}$ to a fraction in its lowest terms, and find the value of ·0125 of £1.

3. If 86 lbs. 7 oz. cost £5 15*s.* 3*d*, what is the price per ounce?

4. Find the simple interest and the amount of £2833 6*s.* 8*d.* at the end of $2\frac{1}{2}$ years, interest being allowed at the rate of 3 per cent. per annum.

5. If 1 oz. of gold be worth £4·189583, what is the value of ·36822916 lbs.?

6. What would be the cost of painting a room whose length is 24 ft. 3 in., breadth 15 ft. 8 in., and height 11 ft. 6 in., at 4*s.* a square foot?

7. A man buys 22 shares in a mine at £6 each, and 78 at 24*s.*, what does he lose by selling them all at 32*s.*?

8. A. B. and C. together can complete a piece of work in 12 days; C. can do it alone in 24 days, and A. in 34 days; in what time would B. do it by himself?

## Ex. 38.

1. Multiply $\frac{1}{2}$ of 1·0076 by 2·0038. Divide ·004 by ·025 and 124 by ·0062.

2. Required the sum and difference of $\frac{2}{5}$ of 5 guineas, and $\frac{3}{4}$ of $\frac{7}{9}$ of £1.

3. Reduce 8*s.* $11\frac{1}{4}$*d.* to the decimal of a guinea, and $\frac{2}{5}$ of a guinea to the decimal of a £1.

4. If the discount on £678 8*s.* which is due at the end of a year and a half, be £38 8*s.*; what is the rate per cent. at simple interest?

5. What income is derived from the sum of £4788 invested in the $3\frac{1}{2}$ per cents. at 105?

6. Extract the square root of 210405·69, and the cube root of 10000000, having given that log. 2·15435 = ·3.

7. A wine which costs £100 the cask is mixed with a wine which costs £70 the cask. In what proportions must they be mixed, so that

if the mixture be sold at £92 the cask, a profit may be made upon each cask sold of 15 per cent.?

8. Divide 54 into 3 parts, such that $\frac{1}{2}$ of the first, $\frac{1}{3}$ of the second, and $\frac{1}{4}$ of the third, shall be all equal?

## Ex. 39.

1. Find the highest common measure of 1379 and 2401, and the value of £7 13*s.* 4*d.* × 73 × 5 + $\frac{1}{17}$ of £106,577 17*s.* 9*d.*

2. Reduce a guinea and a half to the decimal of a pound, and find the value of ·16875 of £1. What fraction of a guinea is a crown?

3. The debts of a bankrupt are £3840, and his assets £828; what dividend in the pound will his creditors receive?

4. If $\frac{5}{7}$ of an estate be worth £870, what would be the value of $\frac{2}{17}$ of it?

5. Explain what is meant by compound interest. What is the difference between the simple and compound interest of £1627 12*s.* 1*d.* for 4 years at 4 per cent.?

6. The cost of a cubic mass of metal is £10,481 1*s.* 4*d.* at 10*s.* 5*d.* a cubic inch; what are the dimensions of the mass?

7. What would be the cost of paving a road of a uniform breadth of 4 yards, extending round a rectangular piece of ground, the length of which is 85 yards and breadth 56 yards, the cost of paving a square yard being 1*s.* 2*d.*?

8. If 7 oxen are worth 42 sheep, and 3 sheep cost £10, what must be given for 100 oxen?

## Ex. 40.

1. Add together $\frac{2}{5}$ of $\frac{4}{5}$, $\frac{5}{9}$, and $\frac{14}{21}$, and put the sum in a decimal form. Multiply (3924—407) by ·017 × 910; and divide ·0140994 by ·0021.

2. What is the area of a floor, of which the length is 17 ft. 2 in. 3 parts and the breadth 15 ft. 11 in. 7 parts?

3. Find the value of $\frac{3}{4}$ of a guinea + $\frac{3}{8}$ of a crown + $\frac{3}{5}$ of 7*s.* 6*d.* — $\frac{3}{4}$ of 2*d.*

4. Extract the square roots of 379·8601, ·04, 9564·84, and the cube root of 2197.

5. What sum of money must be invested in the 3 per cent. consols, when the price of stock is 89$\frac{3}{4}$, to produce an annual income of £35?

6. If 248 men in 5 days, of 11 hours each, can dig a trench 230 yards long, 3 wide, and 2 deep; in how many days, of 9 hours each, can 24 men dig a trench 420 yards long, 5 wide, and 3 deep?

7. If a board be 18 inches broad, what must be its length to contain 15 square feet? Show that a square foot contains 144 sq. in.

8. A man invests £1000 equally, in the shares of two railway companies; the shares of the one are at 3 per cent., and the other at 5 per cent. discount; the price of stock in the former suddenly rises 7 per cent., and that of the latter is depressed 5 per cent. lower than when the man purchased; if he now sell out, what will he gain or lose?

## Ex. 41.

1. There are two numbers, the greater is 3 times 823, and the lesser twice 456; what is their difference? Add together $\frac{7}{16}$ of £2 3*s.* 7*d.* and ·890625 of 5*s.*

2. What will be the expense of painting a surface measuring 23 ft. 6 in. by 20 ft. at the rate of 4*s.* 6*d.* per square yard?

3. If 18 lbs. 3 oz. cost 6*s.* $0\frac{3}{4}$*d.*, what will 2 cwt. 1 qr. 3lbs. cost?

4. Find the simple interest of £250 12*s.* 6*d.* from March 26, 1851, to October 30, 1853, both inclusive, at 3 per cent.

5. The hypothenuse of a right-angled triangle is 75, and one of the sides 45; what is the other side?

6. A. B. and C. had shares in a lottery ticket in the proportion of 3, 5, 7. The prize drawn was £1000; what did each receive?

7. Thread is bought at 14*s.* $6\frac{1}{2}$*d.* per yard, at what price per yard must it be sold, to give a profit of $9\frac{1}{3}$ per cent.?

8. If 10 men working for 9 days, at $10\frac{1}{2}$ hours per day, can finish a piece of work; how much longer per day would each man have to work, supposing that 3 men had been invalid and able to work only 6 hours per day, in order that the work might be finished in 10 days?

## Ex. 42.

1. What will be the cost of 1548 articles at 2*s.* 1*d.* each? Add together $5\frac{6}{7}$ and $\frac{2}{1+\frac{3}{4}}$. Simplify $\frac{5\frac{1}{2}}{1{\cdot}05}$.

2. What is the difference between $\frac{7}{8}$ of £1, and $\frac{2}{5}$ of a guinea, expressed as a fraction of half a guinea?

3. Sound travels at the rate of 1130 ft. a second; how far distant is a thunder-cloud when the sound follows the flash after $\frac{2}{3} \times \frac{6}{7} \times \frac{49}{4}$ seconds?

4. The depth of a canal is 7 ft. 3 in., the width 20 ft. 4 in., and the length 10 miles; how many feet of water will it contain?

5. A. invests £1000 in the 3 per cents. at 84, and B. the same sum in the 4 per cents. at 110; find their respective incomes.

6. Two thirds of a certain number of persons received 1*s.* 6*d.* each, and the rest received 2*s.* 6*d.* each; the whole sum spent was £2 15*s.* How many persons were there?

7. It is impossible that any number multiplied by itself should have 7 for its final figure. The quotient arising from the division of 9281 by a certain number is 17, and the remainder 373 ; find the divisor.

8. A block of wood, in the form of a rectangular parallelopiped, measures along its edges $18\frac{1}{2}$ feet, $5\frac{1}{4}$ feet, and 3 feet, respectively ; determine its value on the supposition that a cubical block, measuring 11 inches along the edge, is worth 3*s*. 6*d*.

## Ex. 43.

1. How many shillings would reach from London to Edinburgh, a distance of 400 miles, the diameter of a shilling being $\frac{3}{4}$ of an inch?

2. Find the difference between $\frac{8}{9}$ of £20 and $\frac{7}{8}$ of 20 guineas.

3. Divide £1 11*s*. 6*d*. by $\frac{1\frac{2}{5}}{3\frac{1}{7}}$; and reduce $\cdot 16\dot{2}$, $\cdot 8\dot{1}\dot{2}$ to vulgar fractions.

4. In what time will 25 men do a piece of work which 12 men can do in 3 days?

5. A younger brother received £8400, which was just $\frac{7}{9}$ of his elder brother's fortune ; what was the father worth at his death?

6. What is the amount of compound interest on £7625 accumulated for 3 years, at 4 per cent. per annum?

7. A. gave 3 hogsheads of brandy, at 6*s*. 8*d*. per gallon, to B., in exchange for 126 yards of cloth; what was the value of the cloth per yard?

8. A hare pursued by a greyhound was 90 yards before him at starting; whilst the hare ran 6 yards, the dog ran 9. How far had the dog run when he caught the hare?

## Ex. 44.

1. A piece of iron weighs 3 cwt. 2 qrs. 8 lbs., how many such pieces will be contained in 96 cwt. 1 qr. 20 lbs.?

2. Reduce 7 oz. 4 dwts. to the decimal of a pound troy, and 9 oz. $2\frac{2}{7}$ dr. to the decimal of a pound avoirdupois.

3. Find the value of $\frac{1}{1+}\ \frac{1}{1+}\ \frac{1}{1+}\ \frac{1}{2+}\ \frac{1}{3+}\ \frac{1}{8}$. What must be added to the sum of $\frac{5}{8}$, $1\frac{17}{24}$ and $\frac{13}{36}$ to make the total 3?

4. Divide £64 among three persons, so that the first may have three times as much as the second, and the third may have one-third of what the first and second have together.

5. If £1000 be laid out in the purchase of 3 per cent. consols at $81\frac{5}{8}$, at what price must the stock be sold to produce a gain of £100?

6. Find the solid content of a cube whose side is 7 ft. 5 in., and the side of a cube containing 4 solid ft. 1088 ins.

7. If 14 men, working 9 hours a day, dig a trench 140 yards long, 2 wide, and 2 deep, in 4 days; in how many days will 36 men, working 8 hours a day, dig a trench 280 yards long, 4 wide, and 2 deep?

8. A man sells a watch for £51, and by so doing lost 15 per cent., whereas he ought to have gained 25 per cent.; how much was it sold under its true value?

## Ex. 45.

1. In 78 guineas, how many two-penny pieces? Divide 244 qrs. 3 bush. 1 peck by 3 qrs. 3 pecks.

2. Find the amount of wages of 6 labourers for $28\frac{1}{2}$ days at 2*s.* 3*d.* each per day.

3. Reduce $\frac{5}{6}+\frac{51}{55}+\frac{4}{21}+\frac{5}{11}+\frac{44}{45}$ to a decimal, and $570\frac{146}{355}$ oz. to the fraction of a cwt.

4. What sum will discharge a bill of £18 9*s.*, abatement for present payment being made at 10 per cent.?

5. Multiply the square root of 66·455104 by the cube root of 8242408.

6. Three merchants, A., B., and C., freight a ship with 340 tuns of wine; A. loaded 110 tuns, B. 97, and C. the rest. In a storm the seamen were obliged to throw 85 tuns overboard; how much must each sustain of the loss?

7. A father left his son a fortune, $\frac{1}{4}$ of which he ran through in 8 months, $\frac{3}{7}$ of the remainder lasted him 12 months longer; after which he had £820 left. What sum did the father bequeath his son?

8. Find the length of a paper $\frac{7}{8}$ of a yard wide required to cover the walls of a room, whose length is 27 ft. 5 in., breadth 14 ft. 7 in., and height 12 ft. 10 in.

## Ex. 46.

1. Reduce $\frac{3872}{92807}$ to its lowest terms; and $\frac{1}{5}$ of $\frac{6}{11}$ of half-a-crown to the fraction of a guinea.

2. If $\frac{3}{16}$ of a lottery ticket be worth £4 10*s.*, what is the value of $\frac{1}{5}$ of it?

3. Find decimal fractions corresponding to $\frac{13}{99}$, $\frac{17}{1375}$; and find the value of ·9375 of a cwt.

4. If the rents of a parish amount to £2340 17*s.* 6*d.*, and a rate be granted of £137 10*s.* 8*d.*, what portion of it must be paid by an estate whose rental is £143 9*s.* 10*d.*?

5. Distinguish between simple and compound interest. A. and B. each lend £895 16*s.* for 2 years, at $3\frac{1}{2}$ per cent. per annum, one at simple interest, the other at compound interest; find the difference of the amount of interest they respectively receive.

6. What length must be cut off a board, which is $6\frac{3}{4}$ inches broad, that the area may contain a square foot?

7. Which is the better investment, the $3\frac{1}{2}$ per cents. at 96, or the 4 per cents. at 111; and what is the difference per cent. between them?

8. If a commodity be bought for £3 8*s.* 5*d.* per cwt., and sold for 8*d.* per pound, what is the profit per cent.?

## Ex. 47.

1. If the lower line in a subtraction sum be 123456789, and the remainder 6789, what is the upper line? Multiply, ·145 by ·48 and reduce 15 hrs. 14 mins. 6 secs. to the decimal of 2 days.

2. Which is the greatest of the three fractions $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$? Add together $387\frac{1}{2}$, $285\frac{1}{4}$, $394\frac{1}{3}$, and $\frac{2}{5}$ of 3704.

3. What fraction of a crown is $\frac{3}{5}$ of 6*s.* 8*d.*? Extract the square root of $\frac{275}{341}$ to 5 places of decimals.

4. How much land, at 27*s.* an acre, should be given in exchange for 480 acres at 35*s.* an acre?

5. Find the present worth and discount of £651 13*s.* 4*d.* due 5 months hence, at $4\frac{1}{2}$ per cent.

6. If a broker be allowed $1\frac{1}{4}$ per cent., what is his demand for disposing of goods to the value of £729 10*s.* 6*d.*?

7. A Turkey carpet, measuring 11 ft. 6 in. by 9 ft. 8 in. is laid down on the floor of a room measuring 14 ft. by 12 ft. 6 in., determine the quantity of floor-cloth necessary to complete the covering of the area, and its price at 6*s.* per square yard.

8. Two persons A. and B. travel between London and Lincoln, distant 100 miles, A. setting out from London, and B. from Lincoln at the same time. After 7 hours they met on the road, when it appeared that A. had travelled $1\frac{1}{2}$ miles an hour more than B. At what rate per hour did each of them travel?

## Ex. 48.

1. A.'s age is $\frac{1}{3}$ of B.'s, and B.'s $\frac{2}{5}$ of C.'s, and C. 10 years ago was 80, what are their respective ages?

2. An officer's pay is 12*s.* 3*d.* per day; what is that a year? How much may he spend a week, in order to lay by £50 a year, his uniform and other expenses amounting to £48 15*s.* 3*d.*?

3. Find the value of ·75 of 6*s.* 8*d.* $-1{\cdot}84375$ of 4*s.* $+3{\cdot}97916$ of 2*s.*

4. Reduce $\frac{3\frac{1}{6}}{1\frac{1}{13}}\left\{\frac{19}{120}\text{ of £}1-\frac{7}{48}\text{ of }1s.\right\}$ to the fraction of a moidore.

5. If two men in a tour of 3 months spend £140, how much at the same rate would it cost a party of five persons, travelling 11 months?

6. What is the difference between one area of $7\frac{1}{2}$ feet square, and another of $7\frac{1}{3}$ square feet?

7. Find the value of a legacy of £2000 stock in the 3 per cents. at $92\frac{1}{8}$, the legacy being subject to a duty of 10 per cent.

8. If a piece of work can be done in 50 days by 35 men working at it together, and if after working for 12 days, 16 of the men were to leave the work; in what time would the remaining men finish it?

## Ex. 49.

1. Define a *proper*, an *improper*, and a *continued* fraction. Find the value of $\frac{5}{32}$ of $\frac{16}{3}$ of £273 2*s.* 6*d.*

2. Simplify the following expressions: $\frac{3}{4}+\frac{7}{9}-1\frac{5}{12}$ and $\frac{\frac{3}{5}\times\frac{2}{5}-\frac{1}{6}\div\frac{8}{3}}{\frac{1}{4}\times\frac{1}{7}+\frac{1}{16}\div 2\frac{1}{3}}$.

3. Find the value of ·123 and ·123 of £1. Divide 201·009 by 3·015 to 3 places of decimals.

4. By how much does the interest of £1073 exceed the discount for 12 months, at 5 per cent.?

5. What must be the length of a room whose breadth is $15\frac{3}{4}$ feet, that the area may contain 23 square yards?

6. If I sell at $6\frac{1}{2}$ what I bought for $7\frac{1}{4}$, what do I lose per cent.?

7. Two horses can eat a stack of hay in 40 days, and 7 horses and 4 cows can eat the same in 10 days, in what time will 1 cow eat it?

8. B. and C. traded together and gained £100; B. put in £640; C. put in so much that he received £60 of the gain; how much did he put in?

## Ex. 50.

1. State the rules for the placing of the decimal point in the multiplication and division of decimals. Divide 14 by ·7854, and reduce to their equivalent vulgar fractions ·75, 3·045 and ·318.

2. What number is that of which 9 is $\frac{2}{3}$? Reduce 1 mile 13 poles to inches, and 51304 sq. yds. to acres, &c.

3. From $\frac{2}{5}$ of a guinea take $\frac{3}{4}$ of 7*s.* 6*d.*, and reduce the result to the decimal of a moidore.

4. What part of a mile is the side of a square whose area is an acre?

5. Find the value of $\sqrt{52034\frac{19}{27}}$, and $(1{\cdot}331)^{\frac{2}{3}}$.

6. If 25 men do a piece of work in 24 days, working 8 hours a day, in how many days would 30 men do the same piece of work, working 10 hours a day?

7. A rectangle whose sides are 6 and 8 feet is estimated by an incorrect foot measure, whose real length is 11·9 inches; find the error in the area.

8. A schoolmaster being asked how many scholars he had, said, If I had as many more, half as many more, and one quarter as many, I should have 99; how many had he?

## Ex. 51.

1. The twelfth part of a number is 1234, what is the number? Find how many inches there are in 5 miles, 1 furlong, 151 yards.

2. Reduce 5 yds. 2 qrs. 7 ins. to the decimal of a yard; and find the value of that length of ribbon, when a piece of 100 yards costs 7*s.* 6*d.*

3. An acre is 22 yards broad and 220 yards long, what would be its breadth if it were 55 yards long?

4. Find the accurate present worth of £100 due 1 year hence, at 5 per cent.; and the present worth that would be paid by a banker.

5. How much stock must be bought at $88\frac{1}{2}$ per cent., in order that, by selling out at $90\frac{1}{4}$, 20 guineas may be gained?

6. If 5 horses or 7 oxen eat up a certain quantity of grass in 87 days, in what time will 2 horses and 3 oxen eat the same?

7. A., B., and C. are partners, A. receiving $\frac{2}{5}$ profits, B. and C. dividing the remainder equally; A.'s income is increased by £220, when the rate of profit rises from 8 to 10 per cent.; find the capital of B. or C.

8. A fish swims uniformly round a circular lake, whose radius is $\frac{1}{2}$ a mile, at the distance of 10 yards from the edge, at the rate of $32\frac{3}{4}$ yards in a minute; how long will it be in going once round? ($\pi = 3\frac{1}{7}$.)

## Ex. 52.

1. What will a person's annual income amount to at 15*s.* $7\frac{1}{2}$*d.* a day? Supposing this subject to an income-tax of 7*d.* in the pound, how much will it be diminished?

2. If £1796 18*s.* 6*d.* be divided among 3 persons in payment for labour, when the first had worked three times, and the second twice, as long as the third, what would each person receive?

3. Show that $\sqrt{\cdot 444\ldots} = \cdot 666\ldots$; and find the value of $\frac{3}{8}$ of $\frac{4}{7} - \frac{2}{11}$ of $3\frac{1}{7} + \frac{5}{9}$ of $3\frac{3}{5}$. Reduce the fractions $\frac{8\frac{3}{4}}{5\frac{5}{6}}, \frac{1\cdot 325}{\cdot 0012}$ to their simplest fractional forms.

4. If 6 horses in 2 days, of 12 hours each, plough 17 acres, how many roods will 2 horses plough in 16 days, of 8 hours each?

5. Required the side of a square whose area equals that of a rectangle, the sides of the rectangle being 597 yards, $2\frac{1}{2}$ ft. and 37 yards, 1 foot.

6. I sold a quantity of Virginian snake root for £20, and by so doing lost 20 per cent.; whereas I ought to have gained per cent. as much as the snake root cost. What was my loss in point of trade?

7. What weight of water is there in a cistern whose length is 4 ft. 6 in., breadth 3 ft. 9 in., and depth 2 ft. 6 in.; a cubic foot of water weighing 1000 ounces?

8. At a game of billiards A. can give B. 15 points in 50, and he can give C. 20 in 50; how many can B. give C. in a game of 70?

## Ex. 53.

1. A certain number divided by 75 is 8902; what is the number? If the $\frac{1}{2}$ of 5 were 3, of what number would 5 be the $\frac{1}{4}$th?

2. How do you multiply or divide a decimal by any power of 10? Prove the truth of your answer. Find the value of 2·86805 of 3*s.* + ·83 of 4*s.* − 1·8 of 5*s.*

3. Required the amount, at compound interest, of £257 in 4 years, at $3\frac{1}{4}$ per cent.

4. A person holds as much stock of a certain kind as is worth £879, the price being £97 10*s.* for £100 stock; there is also another stock which sells for £88 5*s.* per £100; how much of the latter stock ought he to receive in exchange for his property in the former?

5. A mutual benefit society is composed of 120 men who pay 4*d.* a week, 90 women who pay 3*d.* a week, and 60 boys who pay 2*d.* a week into it. The society relieves 11 sick members for a year, each with 6*s.* a week; what balance has it at the year's end?

6. If 1000 men have provisions for 85 days, and if after 17 days 150 go away; find how long the remaining provisions will serve the number left.

7. It is required to mix wine worth 4*s.* a quart with wine worth 3*s.* 6*d.* a quart, so that the mixture may be worth 3*s.* 8*d.* per quart. How much of each will there be in one quart?

8. Two farmers rent a field for £84; the one sent into it 25 oxen for 14 days, and the other 49 oxen for 10 days; what share ought each to pay?

## Ex. 54.

1. There are 5 partners in a business which produces £2100 profit; the senior partner has 6 shares, the second 5 shares, and the three junior partners 1 share each. What does each partner receive?

2. Simplify $2 \times \frac{4\frac{1}{7} - 2\frac{1}{4}}{6\frac{1}{2} - 2\frac{1}{7}}$ of $\frac{91}{55}$, and prove that ·05 of £2 10*s.* = ·125 of £1.

3. Multiply 36·2 by 4·57, and subtract 16·5434 from the result. Reduce the sum of ·45 of £5 10*s.* and ·0125 of £4 13*s.* 4*d.* to a decimal of £3.

4. Show that the interest upon £730 at 5 per cent. for 6 months equals that upon £456 5*s.* at 4 per cent. for a year.

5. If a person gives £24 a-piece for railway shares of £20 each, paying interest at the rate of 5 per cent., what interest does he get for his money?

6. An elephant eats 640 lbs. of bread in 4 days; how much will an elephant, half as large again every way, eat in 17 days?

7. There is a number which, if multiplied by $\frac{2}{3}$ of $\frac{4}{5}$ of $1\frac{1}{2}$ will produce 1; what is the square of that number?

8. A merchant barters 1200 lbs. of pepper at 13*d.* per lb. for equal quantities of two species of cotton at 7*d.* and 11*d.* per lb., and for one-third in money; how many lbs. of each sort does he receive, and how much in money?

## Ex. 55.

1. An officer, a boatswain, and 10 men capture a prize worth £100; the officer has 8 times as much, and the boatswain twice as much as the rest of the crew. What is the portion of each person?

2. In an ordinary long division sum the quotient is 18, the dividend 1000, and the remainder 10, what is the divisor?

3. Find the value of $2+\frac{1}{1\cdot2}+\frac{1}{1\cdot2\cdot3}+\frac{1}{1\cdot2\cdot3\cdot4}+\ldots$ correct to 7 places of decimals. Express the sum of $\frac{3}{5}$ of a day and $\frac{4}{5}$ of 6 hours as the decimal of a day.

4. What would be the ready-money payment of an amount of £27 13*s.* 6*d.*, discount at 5 per cent.?

5. Find the length of a cube in inches, each of whose faces contains 4 square feet. What is meant by a *square* foot, and a *cubic* inch?

6. If I buy an article at 10 guineas per cwt., at what rate per lb. must I sell it to gain 12 per cent.?

7. A., B., and C. are to share £100,000 in the proportion of $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$ respectively; but C.'s part being lost by his death, it is required to divide the whole sum properly between the other two.

8. The first, second, and fourth terms of a proportion are $\frac{1}{20}$, 35, and $3\frac{3}{4}$, what is the third term?

## Ex. 56.

1. In an ordinary long division sum, the divisor is 24, the quotient 41, and the remainder 16, what is the dividend?

2. Reduce $\frac{3}{8}$ of a crown $+\frac{4}{5}$ of a shilling to the fraction of a guinea.

3. Find the value of ·5*s.* + ·7 crowns + £·125. Add together the fractions $\frac{1}{8}$, $\frac{2}{10}$, $\frac{4}{15}$, and $\frac{1}{35}$, and reduce the result to its lowest terms.

4. If $17\frac{3}{5}$ ells, each containing 5 quarters, cost £6 17*s.*, how much will 18 yards cost?

5. If when I sell cloth at 10*s.* a yard, I lose 5 per cent., how much shall I gain per cent. by selling at 12*s.* 6*d.* per yard?

6. A person transfers £1000 stock from the 4 per cents. at 90 to the 3 per cents. at 72; how much of the latter stock will he hold, and what will be the alteration in his income?

7. The shadow of a church-tower extends 56 yards from its base; find its height, it being observed that a two-foot rule, held vertically, casts a shadow of 4 ft. 3 in.?

8. The side of one square is 10 ft., and of another 5 ft. How much larger is one square than the other?

## Ex. 57.

1. Simplify the fractions $\frac{2\frac{1}{4}-\frac{2}{3}\text{ of }1\frac{5}{6}}{\frac{1}{5}\text{ of }3\frac{1}{3}+\frac{13}{36}}$; and $\frac{1\frac{3}{4}-\frac{7}{6}\text{ of }\frac{18}{28}}{\frac{5}{6}\text{ of }\frac{12}{20}+5\frac{1}{2}}$.

2. If the coach-fare from Cambridge to London is 21*s.* inside, and 14*s.* outside, find the rate per mile in each case, the distance being 51 miles.

3. What is the worth of 8 squares of glass, each measuring 4 ft. 10 in. long, and 2 ft. 11 in. broad, at $4\frac{1}{2}$*d.* per foot?

4. Reduce $\frac{8}{1\cdot25}$ of a penny to the decimal of a pound. Add together ·37524, ·8, ·643, ·73 correct to four places of decimals.

5. An annuity of £50 is put out to interest immediately after each payment, what will it amount to in 7 years, allowing 5 per cent. simple interest?

6. If 1 lb. avoirdupois be equal to 7000 gr. Troy, and 66 shillings weigh 1 lb. Troy, find the value of 20 avoirdupois ounces of silver.

7. A. employs a capital of £500 in trade, and at the end of 3 years takes B. into partnership, who advances a capital of £800; at the end of 6 years from this time they have gained £600. What is the profit of each?

8. What length of cord will it take to tether an ass, so that he may graze over an acre of ground? (The area of a circle $=3\frac{1}{7}\times(\text{radius})^2$).

## Ex. 58.

1. What is the smallest number that can be exactly divided by the nine digits? Show that $\frac{\frac{5}{6}\text{ of }\frac{4}{10}-\frac{7}{9}\text{ of }\frac{4}{21}}{\frac{5}{6}\text{ of }\frac{2}{15}-\frac{3}{5}\text{ of }\frac{4}{15}}=3\frac{2}{3}$; and reduce £11 6*s.* 5*d.* to the fraction of £9 5*s.* 3*d.*

2. From 17 cwt. 2 qrs. 14 lbs. subtract 18 lbs. in every cwt.

3. Find the value of $1-\frac{1}{2}+\frac{2}{3}-\frac{3}{4}+\frac{5}{6}-\frac{7}{8}+\frac{11}{12}$. What is the vulgar fraction equivalent to $2{\cdot}86 \div {\cdot}013 \times {\cdot}09318$?

4. How much per cent. is 3 farthings in the pound? Extract the square root of 22071204.

5. A person invests £1000 in the 3 per cents. at $88\frac{3}{8}$; what will be the amount of his half-yearly dividends?

6. A. can dig a certain trench in 5 hours, B. in 9 hours, and C. in 15 hours. How long would A. and B. take to dig the trench, C. working for 1 hour?

7. What is the present worth of £120 payable as follows: viz. £50 at 3 months, £50 at 5 months, and the remainder at 8 months, allowing discount at the rate of 5 per cent.?

8. I bought 3 score pieces of holland for 3 times as many pounds, and sold them again for 4 times as many; but if they had cost me as much as I sold them for, what should I have sold them for to gain after the same rate?

## Ex. 59.

1. Express as vulgar fractions ·25, 3·072, 4·113636...; and reduce to decimals $\frac{1}{4}$ of $2\frac{1}{2}$ and $\frac{5}{7}$. Add together $\frac{4}{11}$ of $\frac{2}{3}$ of $\frac{1}{2}$, $\frac{7}{8}$ of $\frac{4}{5}$ of $\frac{10}{33}$, $\frac{2}{5}$ of $1\frac{2}{5}$.

2. Find the interest and discount of £125 8*s.* 6*d.* for $\frac{1}{3}$ a year, at $3\frac{1}{4}$ per cent.

3. What is the value of $\frac{7}{18}$ of a guinea? Reduce $\frac{4}{7}$ of a lb. to the fraction of a cwt., and 13*s.* 6*d.* to the decimal of £4 10*s.*

4. A bankrupt's assets are £675, out of which he pays 15*s.* in the £ on half his debts, and 12*s.* on the other half; find the amount of his debts.

5. A man, after doing $\frac{3}{5}$ths of a piece of work in 30 days, is assisted by another, with whom he completes it in 6 days. How long would each be about it separately?

6. If 1 lb. avoirdupois = 7000 gr. Troy, and 1869 sovereigns weigh 40 lbs. Troy, how many sovereigns will weigh 1 avoirdupois ounce?

7. If 15 men, 12 women, and 9 boys, can complete a piece of work in 50 days; how long would 9 men, 15 women, and 18 boys be in doing double the quantity, the parts done by each in the same time being as the numbers 3, 2, 1?

8. Two men start from the angle A of an equilateral triangle ABC to go round it, one along AB, the other along AC. If the one travelling along AB goes three times as fast as the other, where will they meet?

## Ex. 60.

1. Multiply and divide ·00123648 by ·012; and find the value of $1\frac{8}{25}-\frac{4}{7}$, and $\frac{2}{7}$ of $\frac{7}{8}+\frac{3}{4}$. What number divided by $17\frac{1}{5}$ gives $13\frac{7}{8}$?

2. Find a quarter's rent of 500 acres of land, which is let for £1 1 5*s.* 6*d.* per acre per annum.

3. If 30 men can perform a piece of work in 11 days, how many will accomplish a piece 4 times as large in a fifth part of the time?

4. What is the cost of £850 bank annuities, at $90\frac{3}{8}$ per cent., $\frac{1}{8}$ per cent. being paid for brokerage?

5. Find the length of a room whose breadth is 11 ft. 11 in., and which it takes 17 sq. yds. 2 ft. 131 in. of carpet to cover.

6. What number is that, from which if there be taken $\frac{3}{7}$ of $\frac{3}{8}$, and to the remainder be added $\frac{8}{15}$ of $\frac{5}{16}$, the sum will be 10?

7. If £100 be due from London to Paris, when £1 is worth 25 francs; what sum must be remitted when a guinea is exchanged for 27 francs?

8. A traveller left Lincoln at 8 o'clock in the morning, and walked towards London at the rate of 3 miles an hour; while another set out from London at 4 o'clock the same evening, and walked towards Lincoln at the rate of 4 miles an hour. If the distance between the cities be 130 miles, where on the road will they meet?

## Ex. 61.

1. Subtract unity from the largest number with two digits. How many pieces of coin of 7*s.* 2*d.* are there in £111 16*s.*?

2. Add together $\frac{1}{8}$ of $\frac{5}{7}$, $\frac{1}{4}$ of $\frac{12}{21}$, and $\frac{5}{6}$ of $\frac{9}{14}$; and reduce 3 qrs. 3 lbs. 1 oz. $12\frac{4}{9}$ drs. to the decimal of a cwt.

3. The carriage of 60 cwt. for 20 miles costs £$14\frac{1}{2}$, what weight can be carried 30 miles for £$5\frac{7}{16}$?

4. A straight plank is $3\frac{1}{2}$ inches thick, and $6\frac{1}{4}$ broad; what length must be cut off this uniform thickness and breadth, so as to contain exactly 20 cubic feet of timber?

5. A man who works 10 hours a day does a piece of work in $4\frac{1}{2}$ days; how many hours a day must he work to finish it in 4 days?

6. One tap empties a cistern in 15 minutes, and another fills it in 8 minutes: if both be opened when the cistern is empty, in what time will it be filled?

7. A. is 6 times as old as B. now; in 20 years he will be only twice as old. What are the ages of A. and B.?

8. If 112 lb. avoirdupois make 104 lb. of Holland, and 100 lb. Holland make 89 lb. of Geneva, and 110 lb. of Geneva make 117 lb. of Seville, how many pounds Seville will make 100 lb. avoirdupois?

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## Ex. 62.

1. How many crowns, shillings, and pence are there in $\frac{1}{3}$ of $\frac{1}{2}$ of 81 × £4? What is meant by the "local value" of a figure?

2. Reduce $149\frac{5}{9}$ to an improper fraction, and simplify $\frac{247}{\frac{5}{7}}$ and $\frac{\frac{227}{8}}{7}$.

3. If 24 lb. cost 6*s.* 6*d.* what will 18 parcels cost, each weighing 3 qrs. 18 lb.?

4. A person buys £500 stock at $98\frac{3}{4}$, and sells again at 103; what does he gain by the transaction?

5. Find the interest on £21,801 for 181 days at $2\frac{1}{2}d.$ per cent. per diem.

6. Four partners engage to trade in company; A.'s stock is £150, B.'s £320, C.'s £350, D.'s £500; and they gain £730, how much belongs to each if the gain be divided among them in proportion to their stocks?

7. If a person lend another the sum of £200 for 12 months, how many months should the latter lend the former £150 to requite the obligation?

8. A vessel may be filled from a certain pipe in 5 hours, from another in 6 hours, and from another in 12 hours. How long will it take to fill the vessel when the last pipe runs for one hour and the others till the vessel is filled?

## Ex. 63.

1. Reduce to a decimal $\frac{21}{25} + \frac{170}{125} + \frac{15}{128} + \frac{18}{160}$. Multiply $12\frac{4}{5}$ by $\frac{1}{5\frac{1}{3}}$.

2. Compare the values of $\frac{1}{21}$ of £1, $\frac{1}{22}$ of a guinea, and $\frac{1}{4}$ of 3*s.* $9\frac{1}{2}d.$

3. A horse costs 3 times as much as a pony, and a pony 4 times as much as a saddle, and the price of the saddle is $£\frac{1}{4}$ less than £3. What is the horse worth?

4. The pendulum of a clock vibrates 240 times in 4 minutes, how many times will it vibrate in $1\frac{3}{4}$ hours?

5. If a hogshead of cider containing 110 gallons be purchased for £4 10*s.* 6*d.* and retailed at $1\frac{3}{4}d.$ a pint, what would be gained by the sale?

6. The length of a room being 20 ft., its breadth 14 ft. 6 in., and height 10 ft. 4 in.; how many yards of painting are in it, deducting a fire-place of 4 ft. by 4 ft. 3 in. and two windows each 6 ft. by 3 ft. 2 in.?

7. A merchant mixes wine at 17*s.*, 18*s.*, and 22*s.* per gallon, so that the mixture may be worth 20*s.* per gallon, what quantity of each must he take?

8. A chain is 22 yards in length; find the area of a square field whose side is $10\frac{1}{2}$ chains.

## Ex. 64.

1. A field containing 21 acres 24 poles is to be divided into allotments for 18 poor people; what will be the size of the plots?

2. State in what cases a vulgar fraction can be reduced to a *finite* decimal; and reduce to decimals $3\frac{2}{3}$ of $1\frac{1}{2}$ of $\frac{3}{25}$, and $\frac{1}{1700}$.

3. Extract the square root of 7513081, the cube root of 673373097125, and the fourth root of 194481.

4. Multiply 20·102 by ·0034; and divide 3·4 by ·017, and ·0007 by 140. Verify the last two results by vulgar fractions.

5. Find the simple interest on £545 in 2 years at $3\frac{1}{2}$ per cent. per annum; and the discount on £583 3*s.* due 2 years hence, at the same rate of interest. Explain clearly why these two sums are identical.

6. A man buys 148 yds. at 2*s.* $7\frac{1}{2}$*d.* per yard; at what price per yard must he sell it so as to gain £12 12*s.* 10*d.* by the whole?

7. What would be the difference in annual income from investing £3450 in the 4 per cents. at 92, and the $3\frac{1}{2}$ per cents. at 69?

8. A. and B. have each a sum of money given them, which will support their families for 10 and 12 days respectively; but A.'s money would support B.'s family for 15 days, and B.'s money would support A.'s family for 7 days, with 2*s.* 6*d.* over; what were the sums?

## Ex. 65.

1. If £119,232 1*s.* $10\frac{1}{2}$*d.* be divided equally amongst 3465 persons, how much will each receive?

2. Five pieces of cloth, each containing $17\frac{1}{2}$ yards, cost £19 13*s.* 9*d.*, what will a piece 24 yards long cost?

3. Find the value of $\frac{3}{7} \times 1\frac{2}{5} \times 12\frac{1}{2} \div 6\frac{2}{9}$ and divide $\frac{2}{5}$ of a shilling by $\frac{4}{5}$. What fraction multiplied into the sum of $\frac{3}{8}$, $1\frac{13}{24}$ and $\frac{17}{36}$ will make the product 3?

4. If ·0625 lbs. cost ·4583*s.*, what is the value of ·075 of a ton?

5. A stationer buys 20,000 quills at 3*s.* a thousand; he pays 1*s.* 6*d.* a thousand for having them prepared, and 4*s.* 6*d.* a thousand for their being converted into pens, which he sells at 1*s.* 2*d.* per hundred; what does he gain by the sale?

6. How far will 500 millions of guineas reach, when laid down in a straight line touching one another; supposing each guinea to be an inch in diameter?

7. A gentlemen left his niece by will £558 15*s.* to be paid her with interest at 4 per cent. when she came of age, which was in 5 years, 9 months, and 21 days; what has she to receive in all? (5 y. $9\frac{3}{4}$ m.)

8. Two ships start from the same port; one has sailed 21 leagues due east, and the other 72 leagues due north; what is their distance from each other?

## Ex. 66.

1. Write down in figures "one million two thousand and twenty;". and explain how the value of each figure depends upon its position.

2. A land mile is 1760 yards, and a knot is 6080 ft. How many knots are there in 1406 land miles?

3. Reduce 12 weeks 3 days 4 hrs. 5 mins. 6 secs. to the fraction of a year, consisting of 365 days 6 hrs.

4. Divide ·3 by ·09, and ·042 by ·036. What is the square root of ·01825?

5. If 20 men can perform a piece of work in 12 days, how many men can perform a piece of work three times as great in one-fifth part of the time?

6. If five pounds sterling are equivalent to 126 francs, what is the value in francs of £2 6*s.* 8*d.*?

7. Find the discount on a bill of £273 4*s.* 6*d.* due 3 months hence, allowing interest at $4\frac{1}{2}$ per cent. per annum.

8. A strip of paper 21 miles long and one inch broad is rolled up into a cylinder; what is the radius of the base of the cylinder, it being given that the volume of the cylinder = height × (rad. of base)$^2$ × $\frac{22}{7}$, and that 240 leaves together are one inch thick.

## Ex. 67.

1. Multiply the difference of 12·248 and 10·6752 by the quotient of 9·6195 by 1·21. Find the value of ·782 of a league.

2. Reduce $3\frac{1}{2}$ of 2 ac. 3 r. to the fraction of 2 r. $2\frac{1}{2}$ pl., and add $\frac{3}{4}$ of a lb. Troy to $\frac{1}{6}$ of an oz. What is the fractional value of ·375?

3. Find the greatest number which will divide each of the numbers 741, 1131, 1173 and 1989.

4. What must the 3 per cents. be at, that a purchaser may get 4 per cent. for his money? Find the commission on £713 6*s.* 8*d.*, at $2\frac{3}{4}$ per cent.

5. How many dozens of wine, at £2 a dozen, must be given in exchange for 27 yards of broad cloth at 32*s.* a yard?

6. A merchant buys good at 2 guineas per cwt., and sells them again at $5\frac{1}{4}d.$ per lb., what does he gain per cent?

7. A watch set accurately at noon indicates 5 minutes to 6 at 6 o'clock in the afternoon. What is the time when the watch indicates 6 o'clock?

8. A gentleman has a bowling green, 300 feet long, and 200 feet broad, which he wishes to raise 1 foot higher by means of the earth to be dug out of a ditch that goes round it; to what depth must the ditch be dug, supposing its breadth to be everywhere 8 ft?

## Ex. 68.

1. A man buys 500 figs, 100 peaches, 10 melons, 20 lbs. of grapes, 100 small birds, and 400 oysters. Valuing the figs at $2\frac{1}{4}d.$, the peaches at $5\frac{3}{4}d.$, the melons at $4s.\ 9\frac{3}{4}d.$ each; the grapes at $1s.\ 11\frac{1}{2}d.$ per lb.; the birds at $6\frac{3}{4}d.$ each, and the oysters at 3 a penny, what is the value of the whole?

2. What is the value of $\frac{3}{7}$ of £21 $9s.\ 11d.$? and what fraction of £7 $10s.$ is $\frac{1}{5}$ of $4s.\ 9\frac{1}{2}d.$? Reduce $\frac{2}{3}$ to a fraction with denominator 12.

3. Apply "duodecimals" to ascertain the cubical content of a piece of timber, of which height = 18 ft. 9 in., breadth = 13 ft. 4 in., and length = 8 ft. 4 in.

4. Find the number of grains in 14 lb. 9 oz. 12 dwts. 16 grs.; and the number of half-crowns and half-guineas in 2625 sixpences.

5. Add together $\frac{2}{7}$, $4\frac{1}{3}$, and $\frac{3}{5}$ of 2; and simplify $\dfrac{1}{2\frac{2}{5}+\dfrac{1}{3\frac{3}{7}}}$.

6. What is the difference between the amount of £250 accumulating during 3 years, at 3 per cent., compound interest, and the amount of the same sum for the same period at 4 per cent., simple interest?

7. Find the time between three and four o'clock, when the hour and minute hand of a watch are exactly opposite each other.

8. A. and B. shoot by turns at a target; A. puts in 3 arrows out of 7, and B. 2 arrows out of 5. How many must each shoot, that they may put in 29 arrows between them?

## Ex. 69.

1. A wedge of gold weighs 50 shekels, and a shekel weighs 9 dwts. 3 grs. How many grains does the wedge contain?

2. Divide the cube root of 122615·327232 by $\frac{5}{6}-\frac{3}{4}+\frac{2}{3}-\frac{1}{2}$. Express $2s.\ 6d.$ in terms of the decimal coinage.

3. Two pipes fill a cistern in 3 and 4 hours respectively, in what time will they fill it together?

4. A room is 16 ft. 8 in. long, and 15 ft. 9 in. broad; find the expense of carpeting it at $6s.\ 6d.$ a square yard.

5. Divide £740 between three persons so that the second may have £30 more than the first, and the third £50 more than the second.

6. A. can do a piece of work in 12 days; but after he has been upon

it 3 days, B. is sent to help him, and they finish it together in 4 days. In what time would B. have done the whole?

7. If 1728 wine glasses were bought for £65 2*s.*, how must they be sold per dozen, to gain 10 guineas by the sale of the whole?

8. If 6 eggs are worth 10 *danari*, and 12 *danari* are worth 4 thrushes, and 5 thrushes 3 quails, and 8 quails 4 pigeons, and 9 pigeons 2 capons, and 6 capons a measure of wheat; how many eggs are worth 4 measures of wheat?

## Ex. 70.

1. What is the cost of a gross of corks at $2\frac{3}{4}d.$ per dozen. Subtract ·84738 from ·9356 to five places of decimals. Explain clearly why you carry 1 when you borrow 10.

2. Add together $\frac{6}{7}$, $1\frac{2}{3}$, $\frac{9}{14}$ and $1\frac{5}{6}$, and explain your mode of operation. Also divide $\frac{2\frac{4}{11}}{2\frac{3}{5}}$ by $\frac{2\frac{7}{11}}{8\frac{7}{10}}$. Simplify $\frac{38}{35} \times 2\frac{1}{7} \times 2\frac{\frac{1}{4}}{4\frac{3}{4}} + \frac{5}{14}$.

3. Find the value of ·0474609375 of £10 13*s.* 4*d.*, and express the result as the fraction of £1.

4. If a ship's crew, consisting of 100 men, can eat 30 casks of biscuits in 9 weeks, in how many weeks can a fleet of 15 ships, each ship containing 600 men, consume 900 casks?

5. How much will remain of $43\frac{3}{8}$ square yards of carpet after covering a room $23\frac{3}{4}$ ft. long, and $16\frac{7}{12}$ ft. broad?

6. A person having an income arising from £360 10*s.* at $3\frac{1}{2}$ per cent., exchanges it for an income arising from £315 at 4 per cent.; what is his annual loss or gain?

7. A father bequeathed to his son $\frac{18}{20}$ of his estate, and the rest to his daughter. When these legacies came to be paid, one amounted to £1200 more than the other; what did the testator die worth?

8. A detachment, consisting of 4 companies, is sent into a garrison, in which the duty requires 60 men a day. What number must each company furnish in proportion to its strength, the first consisting of 42 men, the second of 49, the third of 56, and the fourth of 63?

## Ex. 71.

1. Reduce 34 tons 17 cwt. 1 qr. 19 lbs. to ounces; and find how many yards, feet, and inches there are in 4528 in.

2. Add together $\frac{5}{14}$ of a guinea, $\frac{5}{6}$ of a shilling, and $\frac{1}{12}$ of half-a-crown; and reduce the result to the fraction of £5.

3. The area of the side of a cube being 1369 square feet, find the number of solid feet in the cube.

4. A bankrupt owes A. £515 12*s.* 6*d.*, B. £407, and C. £293 6*s.* 8*d.*;

his estate is worth £911 19*s.* 4½*d.*; how much can be paid in the pound, and what will A., B., and C. receive?

5. When £100 stock may be purchased in the 3 per cents. for £89½, at what rate may the same quantity of stock be purchased in the 3½ per cents. with equal advantage?

6. The price of 100 bricks, of which the dimensions are 16, 8, and 10 respectively, is £6; what will 100,000 cost a quarter less in every dimension?

7. Find a number which being increased by its third and fourth parts becomes 38.

8. A boat's crew row 3½ miles down a river and back in 1 hr. 40 m. Supposing the crew can row at the rate of 5 miles an hour in still water, and the current to run 2 miles an hour, find the time of going and returning.

## Ex. 72.

1. Find the value of $5\frac{1}{3}$ of $4\frac{1}{2} - 3\frac{1}{4}$ of $3\frac{1}{5}$, and reduce $\frac{13}{60}$, $\frac{25}{99}$, and $\frac{1}{6}$ to decimals. Shew that 3·3 is a fourth proportional to $\frac{1\frac{1}{2}}{3}$, $\frac{2}{5}$ and 2·75.

2. Write down, in figures, the number "three millions four thousand and three." Also write down, in words, the signification of the same figures when the last two of them are marked as decimals.

3. What is the tax upon £745 14*s.* 8*d.* at 3*s.* 6*d.* in the pound? And what is the rental of a parish where a "two and ninepenny rate" raises £352?

4. If 1500 pamphlets, each containing 10 sheets of paper, consume 30 reams of paper in printing, how many reams will the same number of pamphlets require, each containing 12½ sheets?

5. A ship and its cargo are worth £17,600, and the cargo is worth seven times as much as the ship; find the value of the ship.

6. The simple interest of £547 2*s.* 6*d.* for 5½ years is £120 7*s.* 4½*d.* what is the rate per cent.?

7. Find the least fraction which, added to the sum of $\frac{3}{4}$, $\frac{7}{8}$, and $\frac{5}{12}$, shall make the result an integer.

8. One man can walk from one town to another in 1 hour less than the other man can, and, when they start together from opposite ends of the distance and walk in contrary directions, they meet at one-third of the distance from one town; if the faster one walks 5 miles an hour, what is the distance between the towns?

## Ex. 73.

1. Find the least number which can be divided by each of the numbers 849 and 1132. Subtract four from four millions.

2. Reduce 1 foot 3 inches to the decimal of a yard, and find the number of pence in ·0208 of £1. Simplify $1{\cdot}3 \times (2{\cdot}\dot{4} + 7{\cdot}5)$.

3. Add together $\frac{3}{7}$, $\frac{17}{21}$, and $\frac{6}{84}$. How much per cent. is 3*d.* in 2*s.* 1*d.*?

4. £170 is due the 12th of August, of which £54 is paid on the 18th of September, £56 on the 17th of October, and the balance on the 14th of November; how much interest is due at 5 per cent.?

5. A tradesman buys $17\frac{1}{2}$ cwt. of sugar for 35 guineas, and retails it at $7\frac{1}{2}$ per lb.; what was the gain per cent.?

6. If a pipe of wine, containing 115 gallons, cost 90 guineas, what is that per dozen bottles, supposing that a gallon is equal to 5·7 bottles?

7. A bill of £13 7*s.* 8*d.* was paid by an equal number of sovereigns, half-crowns, shillings, sixpences, and fourpenny pieces; find the number used.

8. If gold can be beaten out so thin that a grain will form a leaf of 56 square inches, how many of these leaves will make an inch thick, the weight of a cubic foot of gold being 10 cwt. 95 lbs.?

## Ex. 74.

1. How many pounds sterling are there in 1076 dollars at 4*s.* 3*d.* a dollar? Find the value of $\frac{2247}{1017} + \frac{903}{1017} \times \frac{774}{565} + \frac{1926}{1693}$, and the square root of 16489·1281.

2. Express ·375 of a guinea + $\frac{3}{16}$ of a crown + ·3 of 7*s.* 6*d.* − $\frac{3}{8}$ of 2*d.*, as the decimal of 16*s.*

3. A sum of money, at 5 per cent. simple interest, amounts from March 4th, 1850, to July 28th, 1851, to £561 15*s.*; what is the sum?

4. If 18 men consume £30 in value of corn, in 9 months, when the price is 16*s.* per quarter, how many will consume £54 in value in 6 months, when the price is 12*s.* per quarter?

5. When the 3 per cent. stocks are at $90\frac{5}{8}$, and the $3\frac{1}{2}$ per cents. at $97\frac{7}{8}$, in which may capital be invested to the greatest advantage?

6. Supposing a sheep, weighing $19\frac{1}{2}$ stone (stone = 8 lbs.) were bought at 3*s.* $2\frac{3}{4}$*d.* a stone, and retailed at $5\frac{3}{4}$*d.* per lb., what would be gained by the sale? And if the purchaser sold two sheep every *working* day throughout a year, what would be his gains at the expiration of that period?

7. If an express train can travel 119 miles in $1\frac{3}{4}$ hour, and an ordinary train 85 miles in 2 hours 40 minutes, compare in lowest terms their rates of travelling.

8. The number of letters posted in London was 6,430,000. Of these 7 per cent. were unpaid; and of the paid letters 75 per cent. were stamped. What was the number of stamped letters?

## Ex. 75.

1. What is the difference between $7\frac{4}{5}$ and $7 \times \frac{4}{5}$? Divide $15\frac{3}{5}$ by $7\frac{4}{5}$; and add together $£\frac{15\frac{3}{5}}{7\frac{4}{5}}$, $\frac{1}{8}$ of £140 10*s.* 6*d.*, and $\frac{3}{5}$ of a guinea.

2. How many square feet are there in the floor of a room which measures 18 feet by $15\frac{1}{2}$ feet? What is the difference between a *linear* foot, a *square* foot, and a *cubic* foot?

3. Find the import duty on 45 tons 17 cwt. 2 qrs. at £7 18*s.* 4*d.* per ton. What is meant by an aliquot part?

4. A person bought 180 oranges at 2 a penny, and 180 more at 3 a penny; after which he sold them out again at 5 for twopence; did he lose or gain by the bargain?

5. If 3 men or 4 women can do a piece of work in 56 days, how long will 1 man and 1 woman, working together, be in doing it?

6. A person with £12 has to pay for 4 cwt. 3 qrs. 26 lbs. of sugar, at 2 guineas a cwt., and is to spend the rest in coffee at 1*s.* 3*d.* per lb.; how much does he buy?

7. A cubical box contains 9261 cubic inches; find the expense of gilding it at 3 farthings a square inch.

8. The true length of a year is 365·242264 days. According to the Julian correction of the calendar, the common year consists of 365 days, but a day is intercalated every fourth year; according to the Gregorian alteration, this intercalation is omitted in the years beginning centuries which are not multiples of 4. Find the error in a thousand years, according to each system. Show, also, that, according to the Gregorian system, there are only four days in the week on which a century can begin. In the Julian calendar, in how many years will the error amount to a day?

## Ex. 76.

1. Divide the excess of one hundred and nine millions, twenty-five thousand, and fifteen above ninety millions, five hundred and five thousand, one hundred and twenty by four hundred and five; and express the result in *words*. If we count by *sevens* instead of *tens*, how will 20 be expressed in *figures*?

2. The earth in its annual course travels 596,088,000 English miles; what is its rapidity per hour, if the year contain $365\frac{1}{4}$ days?

3. A family consists of five children. The ages of the second, third,

fourth, and last are respectively $\frac{9}{10}$, $\frac{3}{4}$, $\frac{3}{5}$, $\frac{1}{2}$ the age of the first. If the united ages be 75, what is the age of each?

4. Find the fraction of £1 which is equivalent to the excess of $\frac{2}{3}$ of a guinea above the sum of $\frac{3}{4}$ of a shilling and $\frac{4}{5}$ of 7*s.* 6*d.*

5. Four sirloins of beef, weighing severally $28\frac{1}{2}$ lbs., $37\frac{1}{4}$ lbs., $45\frac{1}{2}$ lbs., and $56\frac{3}{4}$ lbs., were purchased at 3*s.* $4\frac{1}{2}$*d.* per stone (8 lbs.), and sold at $7\frac{3}{4}$*d.* per lb.; what would be gained by the sale of the whole?

6. A person possesses £750 in the 3 per cents., and £650 in the $3\frac{1}{4}$ per cents.; he sells the former at $96\frac{3}{8}$, and the latter at $97\frac{1}{2}$, and invests the proceeds in railway stock which pays 5 per cent.; he thus improves his yearly income by £10 12*s.* 9*d.* What is the price of £100 of railway stock?

7. Find the thickness of a tree which a man can exactly clasp round with three grasps of his arms, supposing him to stretch with his arms 6 feet each time.

8. A room, 22 ft. by 19 ft., has a Turkey carpet in it, 19 ft. 6 in. by 15 ft. 9 in., at the price of 12*s.* per square yard; the rest is covered with floor-cloth at 8*d.* per square foot: find the cost of covering the room.

## Ex. 77.

1. Divide 56732 by 45 both by long and short division. What is $\frac{2}{3}$ the $\frac{3}{4}$ of? Find the value of $\cdot\dot{3}\dot{4} - \cdot 12\dot{8}$ and $\cdot 94\dot{3} - \cdot 6\dot{8}\dot{2}$.

2. If an hour of time is equal to 15 degrees of longitude, and St. Petersburgh be situated 30 degrees east of London, what will be the time there when it is noon with us? Where must a place be situated, if the time be 6 hr. 36 min. A.M. when it is mid-day with us?

3. A druggist has two sorts of bark, worth 5*s.* 9*d.* and 10*s.* per lb.; what portion of each must he take to make a mixture of $1\frac{1}{2}$ cwt. that shall be worth 8*s.* 6*d.* per lb.?

4. How many three-inch cubes can be cut out of a twelve-inch cube?

5. A bill of £12 7*s.* $1\frac{1}{2}$*d.* is owing by a party of friends. Of how many persons does it consist, when one of them pays £5 9*s.* 10*d.* for himself and three others?

6. The Earth is distant from the Sun 96 millions of miles, and describes her orbit round him (nearly) in 365 days; at what rate per minute does she travel?

7. Three planets are observed to be together in the same quarter of the heavens, and they perform their courses round the sun in 87, 232, 1218 days respectively; find how soon they will be together again.

8. If one circular pipe 6 inches in diameter can empty a tank in 4 hours, how long will two pipes 4 inches in diameter be emptying the same?

## Ex. 78.

1. When a vulgar fraction can be reduced to a *terminating* decimal, what are the only two figures that can occur in the denominator? Which of the fractions $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{7}$, $\frac{1}{8}$, $\frac{1}{9}$, $\frac{1}{10}$ will *repeat*?

2. Divide the sum of the square roots of $\frac{2304}{5184}$ and $\frac{2704}{4225}$ by the square root of $\frac{9216}{12544}$. Of what number is ·01 the square root?

3. A person transfers £11,000 stock from the 4 per cents. at 92 to the 5 per cents. at 110; what is the difference in his income?

4. If a man, walking 7 hours a day, finish his journey in 9 days, in how many days would he have finished it if he had walked 10 hours a day?

5. If 50 pieces of flannel, each containing 48 yards, were purchased in London at 2*s.* 2*d.* per yard, and the shipping of it to America cost 10 guineas, exclusively of 12 per cent. insurance; how must it be sold per yard in that country, to gain 25 per cent. on the whole sum expended?

6. How many gallons of water will a cistern contain whose length is 3 ft. 2 in., breadth 2 ft. 8 in., and depth 2 ft. 6 in., when $277\frac{1}{4}$ cubic inches are contained in one gallon?

7. A person, after doing $\frac{3}{5}$ of a piece of work in 30 days, calls in an assistant, and together they finish it in 6 days; in what time could each do it separately?

8. A property of £20,000, consisting of three farms of unequal value, is to be divided equally among 3 sons; they agree each to take a farm and balance the difference in value by money payments: if the value of the farms be as 11, 8, and 6, find the payments that must be made.

## Ex. 79.

1. If 30 cwt. are carried 15 miles for £5 8*s.* 9*d.*, how far ought 80 cwt. to be carried for £29?

2. Add together $\frac{3}{7}$ of £5 18*s.* 5*d.*, and $\frac{2}{3}$ of $\frac{5}{7}$ of 13*s.* 4*d.*, and reduce 2*s.* 3*d.* to the fraction of half-a-guinea.

3. A. owes B. £56 5*s.*, but B. consents to remit 15 per cent. of the debt for immediate payment: what sum does A. pay B.?

4. State the rules for pointing in square root and cube root. Point ·41679 previous to extracting the square root. What is ·04 the square of?

5. A certain sum of money is to be divided among three persons; the first is to have $\frac{4}{11}$ of the whole, the second $\frac{2}{3}$ of the remainder, and the third £490. Find the portions of the first two.

6. A post is $\frac{1}{5}$ in the earth, $\frac{3}{7}$ in the water, and 13 feet out of the water; what is the length of the post?

7. A ladder, 30 feet long, rests against a wall; the distance of its foot from the base of the wall is half the length of the ladder; find the height of its top from the ground.

8. If 12 labourers, working for 10 hours a day, can accomplish their task in 9 days, but after 5 days two are taken ill, find how much longer per day they must work in order to finish at the proper time—1. when no fresh hands are employed; 2. when two boys are added, a boy's work being $\frac{1}{3}$ that of a man's.

## Ex. 80.

1. The circumference of the earth under the equator is 25,020 miles; at what rate per hour are the inhabitants, situated under the equator, carried from west to east by the earth's rotation?

2. Find a fourth proportional to ·0004, 1·4, and ·02; and add together $\frac{16{\cdot}8}{{\cdot}024}$ and $\frac{1}{{\cdot}0016}$.

3. A. owes B. £100; he gives him $173\frac{1}{4}$ yards of cloth at 5*s.* 3*d.* per yard, 5 cwt. 2 qrs. 14 lbs. of sugar at £2 5*s.* 6*d.* per cwt., and the remainder in money; how much was the money payment?

4. Calculate the simple interest of £380 4*s.* 2*d.* from the 1st of January, 1852, to the end of April in the same year, at $4\frac{1}{2}$ per cent.

5. A certain sum of money is to be divided between four persons in such a manner, that the first shall have $\frac{1}{3}$ of it, the second $\frac{1}{4}$, the third $\frac{1}{6}$, and the fourth the remainder, which is £80; what was the sum?

6. What difference is there between a floor 28 ft. long by 20 broad and two others, each of half the dimensions; and what do all three cost at 45*s.* per 100 ft.?

7. A., travelling at the rate of 12 miles an hour, starts 15 miles behind B., who travels only 10 miles an hour; find when A. will overtake B., and the distance then travelled by each.

8. If, when corn is 2·4375*s.* a bushel, and hay £3·8 a ton, 3 horses can be kept 20 days for $5\frac{1}{2}$ guineas, how many horses may be kept 10 weeks for £65 7*s.* 3*d.* when corn has fallen to 2·1875*s.* a bushel, and hay risen to £4·8 a ton, supposing 5 cwt. of hay to be consumed with 1 qr. of corn?

## Ex. 81.

1. Divide £4002 17*s.* $4\frac{1}{2}$*d.* by $6\frac{1}{4}$. What is the dividend on £1710 14*s.* 6*d.* at 13*s.* $4\frac{1}{2}$*d.* in the pound? Perform the operations indicated below:—

$$\frac{(7+75)\times 43+(4698+315)\div 9}{(73+14-2)-(16\div 2+4\times 7)}$$

2. Reduce 3 weeks 4 days 5 hrs. 6′ 7″ to the decimal of a month; and find the value of ·284375 of a ton.

3. The edge of a cube is 2 ft. 8 in.; what is the area of its face, and its solid content?

4. I bought 40 oxen for £500, and sold 12 at a loss of 3 per cent.; how must I sell the rest per head so as to be free from loss on the whole?

5. If 2 horses eat 8 bushels of oats in twice as many days, how many horses will eat 3000 qrs. in 24 days?

6. How much 4 per cent. stock can be purchased by the transfer of £1000 stock from the 3 per cents. at 72 to the 4 per cents. at 90?

7. The earnings of a man, woman, and boy are as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$ respectively; whilst a boy earns 7*s.* 6*d.*, how much will a man and his wife earn together?

8. A bill of £61, due 4 months hence, would, with interest, amount to £63 0*s.* 8*d.* at the end of the year; find its present value at the same rate of interest? If, at a shop where a year's credit is allowed, I by paying ready money obtain 13 articles to the dozen, at what rate per cent. is the discount allowed?

## Ex. 82.

1. Add together $\frac{3}{7}$ of £2 12*s.* 6*d.*, $\frac{1}{5}$ of $\frac{4}{5}$ of 3 half-crowns, £·03754, and ·9904*d.* Reduce $2\frac{1}{3}$ guineas to the fraction of $£2\frac{1}{3}$.

2. If $\frac{2}{3}$ of a pipe of wine were bottled off into quarts, and the remainder into pints, how many dozen would there be of each?

3. Extract the square root of 36372961, and the cube roots of $405\frac{28}{125}$ and ·296.

4. A ladder 100 ft. long is placed so as to reach a window 40 ft. high on one side of a street, and a window 60 ft. high on the other side; what is the breadth of the street?

5. A ship worth £860 being entirely lost, of which $\frac{1}{8}$ belonged to A., $\frac{1}{4}$ to B., and the rest to C., what loss will each sustain, supposing £500 of her to have been insured?

6. A wall was to be built, 700 yards long, in 29 days. Now, after 12 men had been employed on it for 11 days, it was found that they had completed only 220 yards of the wall. It is required to determine how many men must be added to the former, that the whole number of them may just finish the wall in the time proposed, at the same rate of working.

7. Find the simple interest on £1523 6*s.* 8*d.*, at $4\frac{1}{4}$ per cent., for 292 days. If simple interest at the above rate per cent. be left unpaid, when will it amount to half the principal?

8. A gentleman, having £5 to pay among his labourers, gave to every

boy 6*d.*, to every woman 8*d.*, and to every man 16*d.*; the number of boys, men, and women was the same. How many were there of each?

## Ex. 83.

1. How many bricks, each 9 in. by $4\frac{1}{2}$ in. are required to pave a floor $97\frac{1}{3}$ ft. long and 81 ft. broad? Simplify $\frac{5\frac{5}{8}-2\frac{2}{3}}{11\frac{1}{4}+4\frac{5}{6}} \div \frac{7\frac{10}{11} \text{ of } 2\frac{7}{29}}{5\frac{2}{5} \text{ of } 6\frac{4}{9}}$, and $\frac{\frac{1}{7} \text{ of } (\frac{2}{5}+3\frac{1}{6})+4}{83+\frac{1}{3} \text{ of } 5\frac{1}{11}}$.

2. Find the sum, difference, and product of 3·145 and 2·79682. Divide 733·04 by ·00374, and add together $\frac{107}{210}$, $\frac{1}{5}$ of $2\frac{1}{21}$, $\frac{7^2_7}{90}$.

3. The side of a cube is 6 sq. ft. 36 sq. in.; find its content.

4. A grocer buys 10 cwt. 3 qrs. 21 lbs. of sugar for £30, and pays 12*s.* 6*d.* for expenses? at what rate per lb. must he sell it to gain 50 per cent.?

5. A. can do a piece of work in $10\frac{1}{2}$ days, which A. and B. can do together in $5\frac{3}{5}$ days; how long would B. take to do it alone? In what time will A. by himself do what A. and B. can in 7 days, A. and C. in 9, and B. and C. in 10?

6. If 135 men can dig a trench 48 yds. long, 1 ft. 3 in. broad, and 3 ft. 9 in. deep, in 5 days of 6 hours each, how many men will be required to dig a trench 90 yds. long, 2 ft. 6 in. broad, and 3 ft. deep, in 27 days of 10 hours each?

7. A shilling weighs 3 dwt. 15 gr., of which 3 parts out of 40 are alloy, and the rest pure silver; if the value of silver rises 8 per cent. what must be the reduction in the weight of pure silver in a shilling?

8. If the course of exchange of London on Paris be 25 francs 45 centimes, and of London on Cadiz be 40*d.* the piastre, how many francs are equal to 1 doubloon of 4 piastres?

## Ex. 84.

1. How many roubles at 3*s.* $4\frac{1}{2}$*d.* the rouble are equal to 378 Napoleons at 15*s.* $9\frac{3}{4}$*d* the Napoleon? Find the value in pounds, shillings, &c. of £3·6125.

2. Extract the square root of the product of ·001 and ·625. A cube contains 15 cub. yds. 2 ft. 1673 in.; find its length.

3. Divide £6 16*s.* and 9*d.* between two persons, so that one may have double the sum which the other receives.

4. Five hundred boys are distributed in 3 houses; the smallest house contains $\frac{7}{25}$ of the whole number, and the largest contains $\frac{19}{14}$ of the smallest; what are the numbers in each?

5. A. does $\frac{3}{5}$ of a piece of work in 6 days, when B. comes to help him; they work at it together for $\frac{7}{8}$ of a day, and then B. by himself just finished it by the end of the day; in what time could they have each done it separately?

6. If six and a quarter plums are worth six quarters of an orange, and 12 boys together eat 50 plums and 16 oranges, how much must each boy pay when oranges are sold 7 for 6*d.*?

7. Two persons traded together; the difference of their stocks was £50. The gain of one was £65 and of the other £55; what is each person's stock?

8. The Portuguese league is to the French league as 338 to 143, and 25 French leagues are equal to 1 degree of 69·025 English miles: find the length of the French and Portuguese leagues in English miles.

## Ex. 85.

1. A field of 60 A. 3 R. is divided into equal numbers of plots, of 1 R. 25 P. and of 2 R. 35 P.; how many will there be? Find the value of ·176 of 1 furlong 36 poles 2 yards 5 in.; and reduce 21 lbs. 12 oz. 7·68 drs. to the decimal of 3 qrs. 15 lbs.

2. Required the interest and discount on £150 for 55 days at $4\frac{3}{4}$ per cent.

3. The price of 3 per cent. stock in the funds is $87\frac{1}{8}$, and the price of $3\frac{1}{4}$ per cent. stock is $89\frac{1}{4}$. How much of each can be bought for £4000, and which will give the higher interest?

4. Three persons are to pay a reckoning of £26 in the proportions of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$; how much must each person pay of the reckoning?

5. A footman agreed to serve his master 12 months for £18 and a suit of clothes. At the end of 7 months he was dismissed and received his livery and £8 10*s.*; what was the worth of the livery?

6. I have not 30 geese, but if I had as many more, half as many more and 5 besides, I should have 30; how many have I?

7. The specific gravity of water is 1 and of cork ·24; how far will a cubic foot of cork be immersed in water, if the quantity of water displaced is equal to the weight of the cork?

8. A person in London owes another in Petersburgh a debt of 460 roubles, which must be remitted through Paris. He pays the requisite sum to his broker, at a time when the exchange between London and Paris is 23 francs for £1, and between Paris and Petersburgh 2 francs for 1 rouble. The remittance is delayed until the rates of exchange are 24 francs for £1, and 3 francs for 2 roubles. What does the broker gain by the exchange?

## Ex. 86.

1. What part of 10 shillings is $\frac{2}{9}$ of a crown? Find the value of $\frac{3}{8}$ of $\frac{4}{7}-\frac{2}{11}$ of $3\frac{1}{7}+\frac{5}{9}$ of $3\frac{3}{8}$. Reduce $2\frac{1}{2}$ cwt. to the fraction of 2 tons 12 lbs.

2. If a family of 9 persons spend £300 in 8 months, how much money will serve 17 persons 11 months, at the same rate of expenditure?

3. Find the number of square feet in a floor, of which the length is $10\frac{2}{3}$ yards and breadth $5\frac{1}{3}$ yards. What will be the price of paving it at 2*s.* per square foot?

4. If I gain 6 in 100 by selling oranges 5 for 2*d.*, how must I sell them so as to gain 10 in 100? and what is the cost price of the oranges?

5. A father gives his son $\left(1+\frac{1+\frac{1}{3}}{3}\right) \div \left(1+\frac{1}{3+\frac{1}{3}}\right)$ of $\left(1-\frac{1}{3+\frac{1}{3}}\right)$ + $\left(1-\frac{1-\frac{1}{3}}{3}\right)$ of ·04 of £6000; how much will his daughter receive, if her share is to the son's as $\frac{2\frac{1}{4}-1\frac{1}{3}}{2\frac{1}{4}+1\frac{1}{3}}$ to $\frac{1\cdot1}{7\frac{1}{8}}$?

6. The old Scotch foot = 12·0194 English inches, and the Irish pole = 7 yards English; find how many Scotch feet there are in 1 pole Irish.

7. There is a mixture of 3 different kinds of wine, in which for every 3 gallons of one kind, there were 4 of another, and 7 of a third; what quantity of each is in 294 gallons?

8. Five men in a public office receive £10 a quarter, for which they attend 7 times during that period; but if one or more of them be absent, their shares are divided among those who attend. Now A. and B. never miss; C. and D. are generally absent twice a quarter; and E. once. What portion of the £10 will each receive a quarter?

## Ex. 87.

1. Add $\frac{8}{15}$ of $\frac{5}{6}$ to $2\frac{7}{18}$, and subtract $\frac{5}{9}$ from the result. What fraction of a pound is 6*s.* $7\frac{1}{4}$*d.*?

2. Divide £612 15*s.* by £57, and £525 8*s.* by £37; explaining what sort of numbers the quotient is in each case.

3. How much stock at $90\frac{3}{8}$ will £2353 purchase, brokerage being 2*s.* 6*d.* per cent.?

4. A cylinder floating in water is half immersed; one ounce is placed on the top of it, and it is $\frac{3}{4}$ immersed; what is the weight of the cylinder?

5. The French cubic metre = 220·09687 Imperial gallons, and 1 gallon Imperial = 277·274 cubic inches; how many cubic feet English are there in 1 cubic metre?

6. Find the time in which A. and B. can do together a piece of work which they can do separately in 8 and 6 days. How long must A. work to do what B. can in 8 days?

7. The value of an ounce of standard gold which was £3 17*s.* $10\frac{1}{2}d.$, falls to £3 15*s.* $4\frac{1}{2}d.$; what is the decrease in the value of a bar from which 1000 sovereigns might have been coined?

8. A field rises 1 inch in a yard from S. to N. and is level from W. to E.; find the least cost of making a cricket ground 120 yards square, when earth is moved at 10*d.* a cubic yard.

## Ex. 88.

1. Multiply the difference between 50436 and 49128 by the difference between 12173 and 11846. Reduce $\frac{3}{4}$ of $\frac{1}{2}$ a guinea to the fraction of £1. Find the number of ounces in 8 cwt. 27 lb. 1 oz.

2. Add together £·009765, ·625*s.*, and £4 0*s.* $5\frac{3}{3}d.$ × 9. Find the quotient of $18\frac{1}{3}s.$ by 2*s.* $3\frac{1}{2}d.$

3. The length of a rectangular piece of timber is 9 feet, and it contains 27 cubic feet; how many square inches does its base contain?

4. Express as a simple fraction the ratio $\frac{3}{4} : \frac{4}{5}$. Which is the greater ratio 6 : 7 or 9 : 11?

5. A man leaves £3500 to his wife, son, and daughter; with these directions, that the son's share shall be twice the daughter's, and the wife's twice the son's; what is the share of each?

6. A cubic foot of cork floats in water, with 9·12 inches of its edge above the surface; find the weight of the cork, the weight of a cubic foot of water being 1000 ounces, and the water displaced being equal to the weight of the cork.

7. A cask A. contains 12 gallons of wine and 18 gallons of water; and another cask B. contains 9 gallons of wine and 3 gallons of water; how many gallons must be drawn from each cask so as to produce by their mixture 7 gallons of wine and 7 gallons of water?

8. Three sons inherit in the proportion of 5, 3, 2; the father leaves £6000 in the $3\frac{1}{4}$ per cents., which are at 98, three bills of £900 each, due 2, 4, and 6 months hence, rate of interest being 5 per cent., and ·004 of 8000 £50 railway shares at par. What is the actual value of each son's inheritance?

## Ex. 89.

1. Show that the product of 3846 and 705 = the quotient of 51517170 by 19. How many dozen lemons at $11\frac{3}{4}d.$ per dozen amount to £7 3*s.* $5\frac{3}{8}$? Find the value of $\dot{3} - \dot{0}\dot{9}$ and $37\dot{2}\dot{3} \times \dot{2}\dot{6}$.

2. A person who possessed a $\frac{3}{5}$ share of a coal mine, sold $\frac{3}{4}$ of his interest in it for £1710, what was the reputed value of the whole mine?

3. At what time between twelve and one o'clock do the hour and minute hands of a watch point in directions exactly opposite?

4. What sum of money will amount to £138 2*s.* 6*d.* in 15 months at 5 per cent. per annum simple interest?

5. A cistern has three pipes, A., B., and C.; by A. and B. together it can be filled in 36 minutes, and emptied by C. in 45 minutes, whereas, if A. and C. were opened together, it would be emptied in $1\frac{1}{2}$ hour; in what time would it be filled, if all were opened together?

6. The English shilling contains 80·727 grains of pure silver. If a dollar weighs $412\frac{1}{2}$ grains, and it is valued at 4*s.* 8*d.*; find the quantity of alloy in a dollar.

7. Express each silver coin now current in England by a decimal of $2\frac{2}{5}d.$ If $\frac{1}{10}$ of $2\frac{2}{5}d.$ be the unit of money, what decimal will express 1 half-penny?

8. A ship sails with a supply of biscuit for 60 days at a daily allowance of 1 lb. per man; after sailing 20 days she encounters a storm, in which 5 men are washed overboard, and damage sustained which caused a delay of 24 days, and it is found that each man's allowance must be reduced to $\frac{5}{7}$ lb.; find the number of the crew.

## Ex. 90.

1. Multiply £17 14*s.* $8\frac{1}{2}d.$ by $23\frac{3}{4}$. Find the cost of papering a room 97 ft. 8 in. about, and 9 ft. 10 in. high, at 2*s.* $8\frac{3}{4}d.$ per yard.

2. What is the net weight of 3 barrels, weighing 6 cwt. 2 qrs. 4 lbs., the tare allowed per barrel being 29 lbs.?

3. For what sum should goods, worth £4384 0*s.* 3*d.* be insured at £2 6*s.* 8*d.* per cent., that the owner may recover, in case of loss, the value both of goods and premium?

4. The calamine stone is equal to five times its weight of water, and 1000 parts of pine wood weigh as much as 528 of water; how many parts of pine are equal to 66 of calamine stone?

5. A merchant sold goods for £753 more than he gave for them, and cleared by the bargain 15 per cent.; what sum did he buy them for?

6. If a man receive $\frac{1}{4}d.$ the first month, 1*d.* the second, 4*d.* the third, and so on; how much will he receive in the course of a year?

7. The area of an equilateral triangle, whose base falls on the diameter, and its vertex in the middle of the arc of a semicircle is equal to 100; what is the diameter of the semicircle?

8. What is the course of exchange between London and Paris, if the price of an ounce of standard gold in London be £3 17*s.* 6*d.*, and if the

premium on gold in Paris be 12 francs per thousand? The price of one kilogramme of pure gold at Paris being 3434·44 francs, and one kilogramme = 32·154 English ounces, and 12 ounces of standard gold in England = 11 ounces pure gold.

## Ex. 91.

1. Define "division"; and divide 3472 by 150, explaining clearly the reason of each step of the process.

2. If 100 Austrian lire or zwanzigers are equal to 87 francs, how many zwanzigers is a Napoleon worth?

3. Simplify $\frac{3\frac{1}{2} \text{ of } \frac{5}{8}}{2\frac{5}{8} \text{ of } 3\frac{1}{3}} + \frac{2\frac{2}{11} \text{ of } \frac{11}{12}}{3\frac{1}{6} \text{ of } 7\frac{5}{7}}$. Add together $\frac{15}{16}$ and $\frac{13}{14}$, and from the result subtract the sum of $\frac{14}{15}$ and $\frac{11}{12}$.

4. How many days of 15 hours each would 60 men take, when 45 men require 30 days of 12 hours each?

5. Find the vulgar fraction corresponding to the recurring decimal $2{\cdot}4626\dot{2}$. . . . Reduce 20 ft. $7\frac{1}{2}$ in. to the fraction of a mile, and find the equivalent decimal.

6. Find by Practice the value of 8 tons 2 cwts. 3 qrs. 14 lbs. at £3 10*s.* 6*d.* per cwt., and explain the process.

7. Extract the square root of $\frac{7}{8}$ to four places of decimals, and the cube root of 122615327232.

8. Distinguish between simple and compound interest. What is the simple interest of £960 12*s.* 6*d.* for 5 years 8 months 73 days at $3\frac{1}{4}$ per cent.

9. A person investing in the 4 per cents. receives $4\frac{3}{5}$ per cent. interest for his money; what is the price of the stock?

10. A railway company declares a half-yearly dividend of 10*s.* 6*d.* per share of £30; what is that per cent. per annum?

11. At what price must an article be bought that 13 per cent. may be cleared, when it is sold for £3 10*s.* 6*d.*?

12. If $\frac{2\frac{1}{5} - 1\frac{1}{6}}{\frac{1}{2} + \frac{1}{3} + \frac{1}{4}}$ of a number amount to 62, what is the number?

13. A room 20 ft. 3 in. long by 15 ft. 9 in. wide is painted at 3*d.* per square yard, and costs 27*s.* What is the height of the room?

14. What quantity of water must be added to a hogshead of wine, valued £33, to reduce the first cost to 9*s.* per gallon?

15. If a man spends in four months as much as he gains in three, how much can he lay by annually, supposing he gains £120 10*s.* every 6 months?

16. A., B., C., share the rent of a house in the proportion of 1, 2, 3.

A. remains in the house 9 months, and then B. and C. share the rent in the proportion of 2, 3; B. leaves at the end of 6 months after A., and C. remains in the house 3 months more. What must each pay, the rent being £120 per annum?

## Ex. 92.

1. Divide two thousand millions, five hundred and eighty-four thousand and seventeen, by two hundred and nineteen thousand, five hundred and sixty-one.

2. How long would it require to count eight hundred millions of money at the rate of £100 per minute?

3. Divide 617 loads 1 qr. by 12 qrs. 1 pk.; and find the G. C. M. of 13667 and 14186.

4. Find the least number of pounds which can be paid in either half-crowns or guineas.

5. $\frac{2}{3}$ multiplied by 3 signifies $\frac{2}{3}$ *taken three times*, that is $\frac{2}{3}+\frac{2}{3}+\frac{2}{3}$; what does $\frac{2}{3}$ multiplied by $\frac{3}{4}$ signify?

Add together $\frac{1}{5}$ of $\frac{3}{4}$ of a year, $\frac{3}{8}$ of $\frac{5}{9}$ of a day, and $\frac{7}{8}$ of $\frac{8}{5}$ of $19\frac{1}{2}$ hours.

6. In what number of years will a sum of money at $6\frac{2}{3}$ per cent. simple interest double itself? How much longer will it take at 4 per cent.?

7. A bankrupt's effects amounted to £980 10*s.*, and he paid his creditors 13*s.* 4*d.* in the pound; what was the amount of his debts?

8. Find the value of ·004 of $\frac{3\frac{1}{5}+2\frac{1}{4}}{3\frac{1}{5}-2\frac{1}{4}}$ of $4\frac{3}{4}$ of £40; subtract ·103 from ·1073, and multiply the result by 100,000.

9. What is the present worth of £169 18*s.* 4*d.* due 15 months hence at 5 per cent.? Explain the reason for the process employed.

10. If 9 men earn $£15\frac{1}{2}$ in 13 weeks, what does each man earn per week?

11. A debt is to be paid as follows:—$\frac{1}{2}$ at 8 months, $\frac{1}{3}$ at 12 months, and the rest in $1\frac{1}{2}$ yr.; find the equated time when the whole should be paid.

12. Required the number of acres in a rectangular field, of which the length is 25 chains 8 links, and the breadth 14 chains 75 links.

13. A man owes a banker £200 with interest for two months at 6 per cent. If the 3 per cents. be at 98, how much stock must he sell out to pay his whole debt?

14. A light sovereign being only worth 19*s.* $4\frac{1}{2}$*d.*, what fraction or decimal part of it has been worn away?

15. Divide 1184323 by 589 in the duodenary scale.

16. If a man can beat a boy by $\frac{3}{5}$ of a mile in a race of 4 miles, how

much start must the boy have in order to reach the 10th milestone at the same time as the man? And supposing the man's rate is 5 miles an hour, how long would it take the boy to go $8\frac{1}{2}$ miles?

## Ex. 93.

1. According to the common notation state at length what is signified by 10100101. Multiply 1840 by 101001, and explain the process.

2. The London and Birmingham Railway cost 5 millions or £44,444 per mile; what is the length of it?

3. If the six-penny loaf weighs 31 ounces when wheat is 6*s.* per bushel, what should it weigh when wheat is 6*s.* 9*d.* per bushel?

4. What is meant by an improper fraction, and why is it so called?

Find the sum of $1\frac{2}{5}+1\frac{7}{12}-\frac{5}{6}$ of $\frac{4}{15}$ and divide the result by $21\frac{1}{5}+\frac{3}{10}+4\frac{1}{3}$ of 5. Express $\frac{11}{12}$ of $4\frac{1}{4}d.$ in terms of 9*s.* $7\frac{1}{2}d.$ and subtract $\frac{1}{7}$ of 3*s.* $2\frac{1}{2}d.$ from $\frac{7}{8}$ of $\frac{3}{4}$ of a crown.

5. If a lb. Av. = 14 oz. 11 dwt. 16 gr. Tr.; what is the difference between an oz. Av. and an oz. Tr. (in Troy weight).

6. Supposing a postage-stamp to be an inch long and $\frac{4}{5}$ of an inch broad, how many will be required for papering a room 16 ft. 10 in. long, 15 ft. 9 in. broad, and 12 ft. 6 in. high?

7. What advantages result from the use of "Decimal Fractions" instead of "Vulgar Fractions," and what disadvantages? Compare the magnitudes of ·01 and ·00045. What decimal of a guinea is $\frac{1}{8}$ of £1 6*s.* 3*d.*

8. When a pound sterling is worth in the exchange 25·05 francs, a man sells 45 Napoleons at 16*s.* 2*d.* each. How much does he gain?

9. A., B., and C. are in partnership. The amount of their stock is £100; A.'s gain is £3, B.'s £5, and C.'s £8. What was each man's stock?

10. If an article cost £2 7*s.* 3*d.* and be sold for three guineas, what is the gain per cent.?

11. Extract the square and cube roots of $\frac{1}{5}$, each to three places of decimals.

12. A. and B. together can do a piece of work in 2 days; A. and C. can do four times as much in 9 days; A. B. and C. can do eleven times as much in 18 days. In how many days can each do it separately?

13. Find in a fractional form a 4th proportional to ·3, $\sqrt{169}$ and $\frac{2}{3}$ of $\frac{1}{5}$; and a mean proportional to ·13 and $5\frac{1}{2}$.

14. A general sends away $\frac{13}{28}$ of his army, and then $\frac{2}{5}$ of the remainder; he has now 1350 men. How many had he at first?

15. A person enters France with £57 10*s.*, which he converts into French money; how much ought he to receive when the pound sterling exchanges for 25 fr. 35 cents.?

16. What is the cost of making a ditch 64 yds. 1 ft. 4 in. long, 2 yds. 2 ft. 2 in. wide, and 3 yds. 6 in. deep, at $1\frac{3}{4}d.$ per cubic foot? How long would 4 men, 3 women, and 2 boys together take to make it, working 8 hours a day, if 2 men = 3 women, and 4 women = 3 boys, and a boy earns $1\frac{1}{2}d.$ per hour?

## Ex. 94.

1. It is required to know how many times 17 is contained in 221; *prove* that the common method of "long division" will give a correct answer.

2. If a man take 3744 steps in walking a distance of 1 mile, 1516 yards, what is the length of each step?

3. A bag contains a certain number of sovereigns, 3 times as many shillings, and 4 times as many pence, and the value of the whole sum in the bag is £280. Find how many sovereigns, shillings, and pence, it contains respectively.

4. Simplify the expressions $\frac{1}{13}$ of $\frac{1}{1+\frac{1}{3}}$; and $3\frac{1}{7}$ of $\frac{47}{55}$ of $\frac{34}{15\frac{1}{5}}$ of 108.

$$3+\frac{1}{4}$$

Divide $\frac{48\frac{4}{7}}{1085\frac{7}{10}}$ by $\frac{7\frac{3}{11}}{174\frac{3}{17}}$, and reduce the quotient to the form 1·0$\dot{7}$14285.

5. What is the difference in gallons and lower denominations between $\frac{7}{8}$ of a pipe of wine, and $\frac{2}{7}$ of a hogshead of ale?

6. Explain what is meant by the G. C. M. and the L. C. M. of two or more numbers. What is the best *practical* rule for finding the L. C. M. of numbers? Find the G. C. M. of 308025 and 395641.

7. What is the advantage of a decimal coinage? From the sum of £72 6 fl. 4 c. 8 m. and £9 3 fl. 7 m. take the difference of £39 3 c. 2 m. and £13 2 fl. 4 c.

8. What is a decimal? State the rules for the multiplication and division of decimals. Divide ·96345 by ·3, and find the value of ·5 of £1 11*s.* 4*d.*

9. If 5 oxen can eat a stack of hay in 40 days, in how many days will 10 oxen eat half the stack?

10. Extract the cube root of 731189187729. Divide the square root of the cube root of 64 by the fourth root of 16.

11. Find the area of any one of the six surfaces of a cube containing 11 ft. 675 in.

12. A wine-merchant bought 138 gallons of wine at 10*s.* per gallon, of which he retained 18 gallons for his own use. At what rate per gallon must he sell the remainder, that he may have his own for nothing?

13. Find the amount of £250 for two years at $3\frac{3}{4}$ per cent. compound interest.

14. What is the area of a right-angled triangle whose adjacent sides are 10 and 20?

15. How much does a banker gain by discounting a bill of £403 4*s.*, drawn Oct. 13th at four months, and discounted Dec. 5th at 4 per cent.?

16. A., B., C., rent between them a field of grass for 12 weeks, for £12 16*s.* 8*d.*, and put into it 3, 4, 5 score of sheep respectively. After 2 weeks A. added 2 score, and at the end of 9 weeks removed all; B. withdrew 1 score after 3 weeks, and added 2 score at the end of the fifth week. What ought each to pay? At what rate per acre per annum is this rent, supposing the field to be rectangular, the shorter side 110 yards, and the longer side 440 yards?

## Ex. 95.

1. Subtract £19 13*s.* $10\frac{3}{4}$*d.* from £24 5*s.* $7\frac{1}{2}$*d.* and explain the steps of the operation, so as to *prove* the truth of the result. How much must I pay for 455 Napoleons, at 16*s.* $4\frac{1}{4}$*d.* each?

2. How many farthings are there in 3 sovereigns, 3 half sovereigns, and three half-crowns? Find the number of days, &c. in 1178825 seconds.

3. State the advantages arising from "reducing fractions to their lowest terms." From $\frac{2}{5}$ of a day take $\frac{3}{7}$ of an hour. Which is the greater $\sqrt{\frac{2}{3}}$ or $\sqrt[3]{\frac{2}{3}}$?

4. The aggregate of $\frac{2}{3}$ and $\frac{3}{5}$ of a sum of money is £133; what is the sum? Complete this equation, $3\frac{1}{3}+2\frac{1}{4}-3\frac{1}{3}\times 2\frac{1}{4}+3\frac{1}{3}\div 2\frac{1}{4}+\ldots\ldots=20$.

5. How much may a person spend in 73 days, if he wish to lay by every year 50 guineas out of an income of £450?

6. If by selling tea at 6*s.* 4*d.* per lb. a grocer lose 6 per cent., what was the prime cost per lb.?

7. Find the cube root of 669921·875 cubic feet, and reduce the result to inches.

8. If 3 men working 11 hours a day can reap 20 acres in 11 days, how many men working twelve hours a day will reap a field 360 yards long and 320 yards broad in 4 days?

9. Answer fully the question, "What is the use of decimal fractions, seeing that the greater number of fractions cannot be accurately represented by decimals?" Reduce £4 7*s.* $2\frac{3}{5}$*d.* to the decimal of 7*s.* 6*d.* and divide 75 by ·148.

10. Prove that the decimal ·304565321 is more nearly represented by ·30457 than by ·30456. Find the value of $\sqrt{50}$ to 5 places of decimals.

11. Divide 1065 into parts which shall be to each other in the ratio of 3, 5, 7 ; and also into parts which shall be in the ratio of $\frac{1}{3}$, $\frac{1}{5}$, $\frac{1}{7}$.

12. Find the discount on £212 7*s.* 10*d.* due 3 months hence, the rate of interest being $4\frac{5}{9}$ per cent. per annum.

13. Two acres of land are to be cut from a rectangular field, of which the breadth is 2 chains 50 links, by a line parallel to it. Find the length of the plot.

14. Find by "cross multiplication" the superficial content of a rectangle, whose length is 75 ft. $7\frac{1}{3}$ in. and breadth 38 ft. $3\frac{1}{4}$ in. Why cannot this method with propriety be called "duodecimals ?"

15. The mint formerly made $44\frac{1}{2}$ guineas out of 1 lb. Troy of gold alloy ; $46\frac{20}{40}$ sovereigns are now made out of the same quantity of gold alloy. Is there a gain or a loss by the change ?

16. A person invests £4800 in the 4 per cents at 80, and at the end of each year invests the dividend which becomes due in the same stock. Supposing the funds to remain at 80 for 3 years, find his dividend at the end of the third year.

## Ex. 96.

1. Add together fifty millions, fifty thousand, fifty hundred, and fifty ; and subtract one hundred and fifty three thousand and eight from seven millions, seventeen thousand, and seventy one.

2. How many sacks are there in 193 chaldrons 12 bushels of coals ? Reduce 32115 square inches to yards ; and 17 tons 2 qrs. 5 lbs. to pounds.

3. A prize of 1000 guineas is to be divided among 150 sailors. What is each man's share, after deducting $\frac{1}{8}$th part for the officers ?

4. A square field contains 15 acres, 2 roods, 20 poles ; find its side in chains.

5. When is one number said to "measure" another ? Find the L. C. M. of the first twelve numbers, Subtract $(6-2)(6-3)(6-4)$ from $6(6-1)(6+1)$.

6. State the "Rule of Three," and explain its object. If $\frac{2}{7}$ of an estate be worth 1000 guineas, what will be the worth of ·75 of it ?

7. Find the value of a mixed circulating decimal, whose finite places are 3 and 9, and whose recurring places are 2, 4, and 6.

8. Simplify $\frac{\frac{1}{5}}{5\frac{3}{4}} + \frac{4}{4\frac{3}{5}} + \frac{1}{5}$ of $\frac{3\frac{1}{4}-8\frac{1}{2}}{\frac{1}{2\frac{1}{2}}+\frac{1}{1\frac{1}{3}}}$. Reduce $\frac{5}{9}$ of 10 poles to the fraction of $\frac{1}{16}$ of a sq. mile.

9. A dollar is to a crown as 111 : 120 ; how many dollars are equal in value to £250 ?

10. If the discount on any sum = $\frac{5}{6}$ of the interest on it at 4 per cent., when is the sum due ?

11. A field of grass is rented by two persons for £27 ; the one keeps in it 15 oxen for 10 days, and the other 42 sheep for 7 days. Find the rent to be paid by each, assuming that a sheep eats half as much as an ox.

12. Find the value at £3 17*s.* 10*d.* per ounce of a gold chain weighing 4 oz. 15 dwts. 12 grs., supposing the workmanship to cost 30*s.*

13. What must I give for a freehold, let for £225 a year, so as to have $4\frac{1}{2}$ per cent. for my money ?

14. Show that by multiplying together the length and breadth in feet of a rectangular surface, we get the area in square feet. A room is 15 ft. long, 12 ft. broad, and 9 feet high ; how many square yards of paper will cover its walls ? how many cubic feet of air will it contain ? and what is the superficial content of the room ?

15. What is the cost of £3250, 4 per cent. stock, at 87 ? After receiving a $\frac{1}{2}$ yrs. dividend, the stock is sold out, and the total gain is £195 ; at what price per cent. was it sold ?

16. A foot-path of uniform breadth around a circular field contains as much as $\frac{9}{16}$ of the field. Compare the breadth of the path with the radius of the field.

## Ex. 97.

1. Express in figures the numbers MDII, CLX, XLIX, add them together, and write the sum in Roman letters.

2. If 5 furlongs = 1 kilometre, how many kilometres = 105 miles ? How many pounds of tea, at 4*s.* 2*d.* per lb., can be bought for £37 10*s.* ?

3. How many feet are there in 1 mile 3 furlongs 37 poles 2 yards ; and if a man can step over 1·375 yards at one step, how many steps must he take to walk half a mile ?

4. From the sum of $\frac{284}{3}$, $\frac{51}{12}$ and $\frac{6}{7}$ subtract the sum of $\frac{5}{21}$ and $\frac{1}{28}$. Also, simplify the expression $\frac{6\frac{1}{5}-5\frac{1}{3}}{6\frac{1}{5}+5\frac{1}{3}} \times \frac{108\frac{2}{5}+\frac{4}{2\frac{1}{2}}}{11\frac{1}{2}-\frac{10\frac{1}{2}}{7}}$.

5. Show when a vulgar fraction can be reduced to a *finite* and when to a *circulating* decimal. Will the fractions $\frac{37}{11\times16}$, $\frac{47}{25\times16\times32}$, when reduced to decimals, terminate or not ?

6. If 30 men do $\frac{2}{5}$ of a piece of work in 12 days, working eight hours

a day, in what time will $\frac{3}{4}$ of the same piece of work be done, if half the number of men are taken off after the first day?

7. What are the differences of latitude and longitude between a place lat. 22° 34′ N., long. 88° 34′ E., and another 12° 1′ S., 76° 44′ W.

8. There are two equal rectangles; the length of the one is 10 ft. 6 in., and the breadth 7 ft. 3 in.; the breadth of the other is 4 ft. 2 in.; what is its length?

9. Of every volume of air, 21 per cent. is oxygen; how much oxygen is contained in 25 c. ft. 700 ins.?

10. Give the rules for working examples in interest and discount. If £95 is given for a bill of £100 due a year hence, and discounted at 5 per cent., how much is this sum too little?

11. What sum at 5 per cent. will, in seven years, amount to £334 16*s.*? and at what rate per cent. will £540 amount to £734 8*s.* in 9 years?

12. Find the cube root of 231·475544, and also the cube root of the product of the last-mentioned number multiplied by ·008.

13. A tobacconist mixes 20 lb. at 15*d.* with others at 16*d.* 18*d.* and 22*d.* respectively. How many lbs. of each sort must he take to make 1 lb. worth 17*d.*

14. What will be the radix of the scale in which a number which is double of 145 is expressed by the same digits?

15. A person has 5 sons and 5 daughters, and leaves between them 180 railway shares, each worth £90, minus a commission of 6*d.* in the £. How much does each son receive, supposing a daughter's share to be half a son's?

16. The foot of a ladder is 14 ft. from a wall, and its top touches the wall 48 ft. from the ground. How many steps has the ladder, supposing them to be 9 inches apart, and the lowest one 2 inches from the foot of the ladder?

## Ex. 98.

1. Describe the method by which numbers are represented, and hence explain the ordinary rules for "carrying" in addition and subtraction.

2. There are two numbers, the greater is 37 times 45, and their difference 19 times 4. What is their sum and product?

3. A legacy of £5800, after paying a duty of 10 per cent., was divided equally amongst 5 persons; how much did they each get?

4. If a person count 200 in a minute, and work twelve hours a day without intermission, how long will he be counting a billion?

5. What must I earn in the year if I spend 12 guineas in 35 days, and save £100 a year?

6. From the sum of 321·4, 12, ·01, 31·6154, 2·214, 415·62, take the difference of 4·41967 and 37·001. From 3·45 of 5 guineas, take ·03125 of £1.

7. From the definition of a fraction, prove that $\frac{3}{4}$ is the same as $\frac{9}{12}$; also prove that $\frac{2}{3}$ of $\frac{4}{5}$ is the same as $\frac{8}{15}$. To what number can you add $7\frac{2}{3}$ to make the sum $12\frac{1}{4}$ ?

8. Multiply $11\frac{8}{11}$ by $\frac{1}{7+\frac{1}{8}}$, and divide $16\frac{1}{4}$ by $3\frac{1}{3}$ of $1\frac{1}{8}$, What fraction of 5 guineas is $\frac{3}{25}$ of 9*s.* $4\frac{1}{2}$*d.*

9. What is ratio? When do ratios form a proportion? What number has the same ratio to 365 that 8 has to 73?

10. A court is 25 ft. long and 20 ft. broad, what will be the expense of covering it with tiles 8 inches long and 6 inches broad, at the rate of £1 10*s.* per thousand ?

11. If I buy 80 lbs. of black tea at 4*s.* 3*d.* per lb., and 20 lbs of green at 5*s.* 6*d.*; what will the mixture cost per lb.? and how must I sell it again so as to gain 1*s.* 8*d.* in the £?

12. In what time will £350 amount to £402 10*s.* at 3 per cent. per annum, simple interest? Find the amount of £480 put out for 3 years and 3 months, at £4 3*s.* 4*d.* per cent.

13. A tax of £225 10*s.* was laid upon 4 villages, A., B., C., D.; but when A., B., C. pay 3*d.*, D. pays 2*d.*; what did each pay?

14. A beam is 6 ft. 9 in. long, 2 ft. 3 in. broad, and 9 in. thick; required the side of a cube of equal capacity.

15. Gunter's chain is 4 poles long, and is divided into 100 links. How many square links are there in an acre? Reduce 538200 links to acres.

16. Explain "discount" and "compound interest." If, while the common rate of interest is $3\frac{1}{2}$ per cent., I can get my tradesmen's bills discounted as if it were five per cent.; what is the advantage to me, in an expenditure of £450, of ready money payments, rather than leaving my bills unpaid for 12 months?

## Ex. 99.

1. Distinguish between "Notation" and "Numeration," "abstract," and "concrete" numbers. How do you find by inspection whether a number is divisible by 4, 3, 9 or 11?

2. If 1000 sovereigns weigh 21 lbs. 5 oz. 16 dwts. 6 grs., what is the weight of one sovereign? Divide £313 2*s.* $9\frac{1}{2}$*d.* equally among 29 persons.

3. If 356 acres, 3 roods, $39\frac{1}{2}$ poles let for £951 19*s.* 10*d.*, what is the rent per acre ?

4. The carriage of 4 cwt. 3 qrs. for 160 miles costs £3 17*s.*, what will the carriage of 11 cwt. 3 qrs. 14 lbs. for 100 miles cost? If a man walk 4 ft. per second, and a train go 30 miles per hour, compare their speed.

5. What is the yearly interest of £198 6*s.* 8*d.* at $3\frac{1}{4}$ per cent.? And at what rate will £157 15*s.* 4*d.* amount to £295 16*s.* 3*d.* in 25 years at simple interest?

6. If £7927 10*s.* be laid out in purchasing 3 per cent. stock at $94\frac{3}{8}$, what annual income will be derived from this investment after deducting an income tax of 7*d.* in the £?

7. State and prove the rules for the multiplication and division of fractions. Multiply $39\frac{1}{8}$ by $\frac{9}{47}$, and divide $6\frac{15}{16}$ by $4\frac{5}{8}$, reducing the results to their lowest terms.

8. If $\frac{5}{7}$ of an estate be worth £1003 17*s.* 1*d.*, what is the value of $\frac{3\frac{1}{15} + \frac{1}{3}}{3 + \frac{1}{4} + \frac{2\frac{1}{2}}{5}}$ of it.

9. Reduce $\frac{1}{3} + \frac{1}{6} + \frac{1}{14} + \frac{3}{56}$ to a decimal fraction. What decimal of a cwt. is 1 qr. 7 lbs? Divide 31·5 by ·126, and multiply ·075 by 10,000.

10. What is the value in English money of 1556·85 francs, when the exchange is 24·25 francs per £? Convert ·6125125 . . . into an equivalent fraction, explaining the rule employed.

11. Extract the square root and the fourth root of 1679616; and determine the length of the edge of a cube which contains 37 cubic feet 64 cubic inches.

12. An innkeeper buys port at the rate of £90 per pipe, and retails it at £3 per dozen, each bottle containing $1\frac{1}{2}$ pint. What is his profit per cent.?

13. Find by cross multiplication the product of 8 ft. 6 in. 9 pts. by 7 ft. 3 in. 3 pts.; and show that the same result would have been obtained by using the duodenary scale, or by vulgar fractions.

14. A person with £30 takes a trip of three weeks. His travelling expenses average 5 fl. 4 cents per day, and his hotel bills 4 fl. 2 c. 3 m. per day. What sum has he on his return?

15. On the 1st of Jan. A. brought into a business £350, and on 1st of April £500 more; on 1st of June he takes out £400, three months after this he brought in £600. B. brought into the business £500, four months after this he takes out £150, and on 1st of Nov. brought in £650. At the end of the year their clear gain is £1008. How much ought each to receive?

16. A man dies, leaving 2 sons and 2 daughters, and directs all his property to be sold and divided amongst his children, so that each son

may have half as much again as each daughter. His property consists of 1000 railway shares worth £12 10*s.* each, and £5000 Consols at 99$\frac{3}{8}$. The commission charged on selling is 2*s.* 6*d.* for every £100; what will be each child's share?

## Ex. 100.

1. Prove that the ordinary method of subtracting one number from another, when some of the digits of the lesser number are greater than the corresponding digits of the other, gives a correct result. Subtract ten thousand and one from one hundred and ten thousand and fifty.

2. Share £1000 among 3 people, so that one may receive £118 more than either of the others.

3. Multiply together ·03 and 1·57, and reduce $\frac{5}{32}$ to a decimal. Find the sum of 1·25, ·067 and 23·8; and the vulgar fraction corresponding to the division of ·137 by ·05.

4. What must I subtract from $\frac{3}{2}$ to give a result $\frac{7}{8}$? Add together $5\frac{7}{12}$, $1\frac{2}{5}$, and $\frac{3}{4}$ of 13, and subtract $700\frac{10}{11}$ from $1000\frac{5}{11}$. Reduce $\frac{4}{5}$ of a guinea + $\frac{2}{3}$ of seven shillings + $\frac{3}{7}$ of half a crown − $\frac{16}{35}$*d.* to the decimal of a pound.

5. Extract the square roots of 1·6 and 1·047931 to three places of decimals, and the cube roots of ·004913 and ·000001728.

6. What must be the length of a trench which is $5\frac{1}{2}$ ft. deep, and $9\frac{1}{3}$ ft. wide, in order that the entire excavation may contain 7040 cubic feet?

7. A man mixes 20 gallons of ale, which has cost him 11*d.* per gallon, with 65 of beer, which has cost him 5*d.* per gallon. At what price must he sell the mixture in order to gain 20 per cent. on his outlay?

8. On coming into an annuity of £1000, a person determines to save every year one-fifth of his income and invest it. What will be his income in the fourth year after the annuity commences, supposing him to be able to obtain 5 per cent. for the money which he invests?

9. A bill of £1510 is discounted by a banker $3\frac{1}{2}$ years before it becomes due; what does he deduct if interest is at 5 per cent.?

10. A person leaves to his son £6500, to his brother £1500, to his uncle £300; find the united income of the three at $3\frac{3}{4}$ per cent. per annum, deducting the legacy duty of 1, 3, 5 per cent. respectively.

11. Express £2 5*s.* 6*d.* in florins, cents and mils; and 3 florins, 5 cents, 5 mils in shillings and pence.

12. Find the cost of overlaying with gold a table 6·4285714 yards long, and 1·78 yards wide, at 25*s.* per square inch.

13. When the thermometer is 22° Reaumur, what is it on the Centigrade and on Fahrenheit?

14. The length of the 360th part of the earth's circumference being $69\frac{1}{23}$ miles; what is the earth's diameter, supposing that the diameter of a circle $= \frac{7}{22}$ of its circumference?

15. A tenant holds a farm of 350 acres, subject to a tax of 3*s.* 6*d.* per acre, and a corn rent of 100 quarters of wheat, barley, oats, and beans, respectively. Find the amount of his rent, when the average prices of these per quarter are 38*s.* 9*d.*, 27*s.* 4*d.*, 17*s.* 4*d.*, 33*s.* 10*d.*, respectively.

16. An express train starts for B. at 1 from A., at 30 miles per hour, and in 15′ is followed by an ordinary train at 20 miles per hour. A train going from B. to A. at 25 miles per hour, after travelling 1 hour meets the express, and in 20′ more meets the ordinary. At what time did the train leave B.?

## Ex. 101.

1. State the objects of the four fundamental rules of arithmetic. Write down in figures, eleven thousand eleven hundred and eleven, thirty thousand three hundred and three, and add them together.

2. What is meant by numbers being prime to each other? and what by prime numbers? Find the G. C. M. of 5037 and 5402; and also of 41736 and 6549.

3. If a franc is worth $9\frac{1}{4}d.$, what is the income in English money of a man who receives twelve million and fifty thousand francs per annum? How much would he lose by having it altered to £1080 13*s.* 4*d.* a day?

4. Required the price of 46 quarters 5 bushels of wheat, at £2 18*s.* 8*d.* per quarter; and the rent of 110 acres 3 roods at £3 17*s.* 6*d.* per acre.

5. A bankrupt's estate amounts to £455 1*s.* $6\frac{3}{4}d.$, and his debts to £937 10*s.* What can he pay in the £? And what will a creditor lose on a debt of £114?

6. If it cost £59 2*s.* $1\frac{1}{2}d.$ to keep 3 horses for 7 months, what will it cost to keep 2 horses for 11 months?

7. Divide £11 5*s.* 10*d.* between three persons, in such a way that one of them shall receive three times as much as either of the others.

8. Reduce $2375\frac{3}{4}$ Spanish dollars to English money, the exchange being at 3*s.* 4*d.* per dollar. And find the value of 100,000 rupees at 2*s.* $3\frac{7}{8}d.$ each.

9. What is the square root of $3080\frac{1}{4}$, and the cube root of 9·528128. Find the hypothenuse of a right-angled triangle, of which the sides are 4 feet, and 1 foot 8 inches.

10. In what time will £142 10*s.* amount to £227 5*s.* 9*d.* at $3\frac{1}{2}$ per

cent. simple interest? Find the amount of £370 10*s.* for 3 years at $4\frac{1}{2}$ per cent., compound interest.

11. What income can be derived from the sum of £3714 19*s.*, by investing it in the 3 per cent. Consols, when the price of £100 stock is $95\frac{1}{2}$? Would it be more or less advantageous to invest in the $3\frac{1}{4}$ per cents. at $97\frac{1}{4}$?

12. Give a definition of a fraction, and distinguish between proper, improper, and complex fractions. Simplify $\frac{\frac{1}{2}+\frac{2}{3}+\frac{4}{5}+\frac{1}{30}}{8\frac{2}{3}-7\frac{4}{5}}$, and $(\frac{1}{2}+\frac{1}{4}+\frac{1}{16}+\frac{1}{32})\cdot\frac{910}{0104}$.

13. What decimal of a pound Troy is 1 oz. 1 dwt. 9 grs.? Find the sum of $3\cdot24\dot{5}$ and $2\cdot3\dot{2}4$. In addition or subtraction, why is one decimal point placed under the other?

14. A person owes £800; one-fourth to be paid in three months, $\frac{3}{8}$ in 5 months, and the remainder in 6 months. If the whole sum were to be paid at once, what would the time of payment be?

15. Find the expense of lining a cistern, 10 ft. 3 in. long, 6 ft. 6 in. broad, and 5 ft. $4\frac{1}{2}$ in. deep, with lead at £2 2*s.* per cwt. which weighs 8 lbs. per square foot.

16. Prove the following rule:—To convert any number of pence and farthings *under a shilling* into the equivalent decimal of a pound, reduce the money into farthings; add 1, if the number of farthings be 24 or upwards; and then make three decimal places.

## Ex. 102.

1. Explain the terms *factor, product, quotient.* Find how much more 5736 is than 239; also how often the latter must be taken to make the former.

2. If the National Debt is eight hundred millions, and thirty ten pound notes weigh 1 ounce; what would be the weight of the whole in notes?

3. Multiply 5 acres, 1 rood, 17 poles by 49. By how many pounds does 125 guineas exceed 722 half-crowns?

4. If 44 men consume 1045 lbs. of bread in 19 days, how many days will 7965 lbs. serve 59 men?

5. Divide 100 guineas into an equal number of guineas, half-guineas, crowns, half-crowns, shillings, and sixpences; and reduce the remainder to the fraction of £10. What fraction of a guinea is 17*s.* $7\frac{1}{2}$*d.*?

6. Multiply together ·12 and ·035, expressing the product as a vulgar fraction. Divide $\frac{153}{364}$ by $\frac{5}{7}$, $\frac{7}{16}$ by ·15, and ·016 by $\frac{2}{5}$.

7. Find the value of $(\frac{5}{6}+\frac{7}{8}+\frac{1}{12}+\frac{2}{3}$ of $\frac{3}{7})$ of a quarter of a cwt. Which is the greater $\sqrt{2}$ or $\sqrt[3]{3}$?

8. Find the abstract number which expresses the ratio of £12$\frac{2}{3}$ and 17$\frac{3}{8}$ shillings. The census of 1851 gives the population of a town as 56058, which in 1841 had only 46715 inhabitants; what is the increase per cent.?

9. Determine the expense of papering a room 12 ft. high, measuring 20 ft. by 15 ft. at the rate of 2$\frac{1}{2}$*d.* per square yard.

10. A man buys 25 sheep for £36, and 30 more for £46; what will he gain by selling them at £1 10*s.* 6*d.* a piece?

11. If 7 men can do a piece of work in 11$\frac{1}{2}$ days, in what time will 8 men and 7 boys do the same, if a boy's work is equal to $\frac{5}{8}$ of a man's?

12. Lent 500 guineas at 4$\frac{1}{2}$ per cent., and received in payment for it £700 15*s.* How long was the money lent?

13. A father left his eldest son £1500 more than the youngest, whose fortune was eleven thousand, eleven hundred, and eleven pounds. What was the eldest son's fortune, and what did the father leave them?

14. How many cubic inches of platina will balance 14$\frac{1}{3}$ cubic inches of silver, the specific gravity of platina being 21·5, and that of silver 10·5?

15. Show that if a vulgar fraction in its lowest terms has in its denominator no factor but powers of 2 and 5, it can be reduced to a finite decimal; but not otherwise.

16. A. and B. run in distinct circles which touch in one point, and whose circumferences are 60 yards and 40 yards respectively. They start from the common point, A. running 5 yards to B.'s 4. After how many rounds each will they first meet again?

## Ex. 103.

1. Divide the sum of forty millions fifty thousand and sixty, and thirty-nine millions four hundred and two thousand and eighty, by their difference.

2. Supposing a unit worth 4$\frac{1}{2}$*d.* what is the value of the answer to the last question? Reduce 5 miles, 3 furlongs, 2 yards, 3 inches, to inches.

3. Find the value of ·574 of a hogshead of beer. What fraction of a lb. Troy is $\frac{5}{8}$ of a dwt.? Add 3 poles to ·48125 acre.

4. The capital of a firm consists of £713 3*s.*, £964 17*s.*, £2391 3*s.*, subscribed by three partners; divide £2231 among them in proportion to their several capitals.

5. Define a fraction; and prove that a fraction is not altered in value by multiplying both numerator and denominator by the same number.

6. What are the fractions which express $\frac{1}{3}$ of $215\frac{1}{3}$ square yards in acres, and $\frac{5\frac{1}{12}}{7\frac{1}{14}}$ of 5940 seconds in weeks?

7. At what rate must I sell a commodity purchased at the rate of £14 5*s.* per cwt. so as to gain 21 per cent.

8. If ·045 lb. of sugar be worth ·18*d.* how much must I give for $\frac{7}{18}$ of a hogshead, weighing 6·125 cwt? What is the cost per lb?

9. A creditor receives on a debt of £296 a dividend of 12*s.* 4*d.* in the £, and a further dividend upon the deficiency of 3*s.* 9*d.* in the £. What does he receive in all?

10. Reduce $1 - \frac{4}{\sqrt{17}}$ to a decimal of three figures. Explain why no integer or terminating decimal can have a recurring decimal for its root. In what case can a recurring decimal have such a root?

11. What will £500 amount to in two years, allowing compound interest at the rate of $4\frac{1}{2}$ per cent. per annum?

12. A sum of £500 is due to me at the end of $2\frac{1}{2}$ years; what sum can I afford to take for it now, if I can make $4\frac{1}{2}$ per cent. of my money?

13. Find by cross multiplication the capacity of a cube whose edge is 20 inches; and prove the truth of the result by vulgar fractions.

14. A. can run eight yards in the same time that B. can run 7; how long a start ought A. to give B. in a race of 200 yards, in order to make an even race?

15. If ten men can raise a weight of 1·5 tons through a space of 2 feet in ten minutes, how many men will be required to raise a weight of 5 tons through 1 foot in 15 minutes.

16. A man is a holder of £1500, 3 per cent. Consols, when this stock is converted into a new $2\frac{1}{2}$ per cent. stock, each fundholder taking £100 new stock for every £100 of old stock; what is the change in his $\frac{1}{2}$ yearly dividend? and what the change in his capital if he originally bought in at par, and sells out when the new stock is at 95?

## Ex. 104.

1. The sum of two numbers is 36493214, and one of them is 7320041; find the other. Also, if the less of two numbers be 71849 and the difference 248941, find the greater.

2. In 123456 farthings, how many shillings and pounds? How many fourpenny-pieces are there in 75 guineas and 5 crowns?

3. Define the terms "Common Measure," and "Greatest Common Measure." Find the G. C. M. and L. C. M. of 1280, 1792 and 2048.

4. Two hundred and forty-nine yards of cloth are bought at 3*s.* 4*d.* per yard, and retailed at 4*s.* 2*d.* per yard; what is the profit on the whole, and how much per cent.?

5. Reduce $\frac{91}{147}$ and $\frac{40675}{32876}$ to their lowest terms. What fraction of a moidore added to 16*s.* will make £2?

6. If a store of provision be consumed by 15 men in 20 days, how long will a similar store last 10 men?

7. Explain the nature and use of decimal fractions. What decimal of £5 is £7 16*s.* 10½*d.* and what decimal of £100 is 3¾ of a guinea? Divide 24·075 by ·0075.

8. A wine-merchant mixes together 20 gallons of wine at 12*s.* a gallon, 25 at 14*s.*, and 36 at 16*s.*, what should be the price of the mixture?

9. How many crowns, half-crowns, shillings, and groats amount to £99 16*s.* 4*d.*, taking of each an equal number?

10. A. has an annuity of £896 17*s.*; how much may he spend daily, that at the year's end he may have 200 guineas, and give to the poor quarterly ten moidores?

11. The area of an oblong room is 260 feet, the length of one side is 4 ft. 3 in.; what is the length of the other side? If the diameter of a circle be 50, what is the side of a square equal in area?

12. Distinguish between proper and improper fractions. Show that if the numerator of a fraction be divided by any number, this operation gives a result equivalent to that from multiplying the denominator by the same number.

13. If 3*s.* in the £ be allowed for cash payment of a bill due a year hence, what is the rate of interest implied?

14. Having given log. 2 = ·30103, find log. $\sqrt[3]{0125}$.

15. By selling nuts 60 a penny, a man gains at the rate of 8 nuts upon every 100; how many will he gain upon the 100 by selling them 45 a penny?

16. A father left to each of two sons 1·045 of £4000. One son invested his fortune in a mortgage, yielding 4½ per cent.; the other bought into the 3¼ per cents. at 91, and at the end of 7 years sold out, the stock having risen to 98. Which gains most in the 7 years? How much?

## Ex. 105.

1. Add together the following: — eleven millions, three hundred thousand, four hundred and four; three hundred and sixty-five millions, sixty-six thousand, and thirty-three; one hundred and eleven millions, four hundred and seventy thousand, and fifty; three hundred and twenty-six millions, seven thousand, nine hundred and ninety-one; two thousand five hundred and eight millions, three thousand, eight hundred and six.

2. How many seconds are there in 1 day 5 hours 48 minutes 30 seconds? and how many tons, &c., in 106921 lbs.?

3. Exhibit in one term the expression $3\frac{4}{5} - 4\frac{1}{2} + 7\frac{3}{7} - \frac{3}{4}$. What number multiplied by $\frac{5}{8}$ of $\frac{3}{7}$ of $15\frac{1}{8}$ will produce $\frac{5}{8}$ of an unit?

4. Reduce to a decimal $1004\frac{5}{8} - 626\frac{3}{4} + 1240\frac{11}{12} - 92\frac{13}{16}$; and to vulgar fractions $\cdot 12\dot{2}\dot{4}$, and $23\cdot 4\dot{2}\dot{3}$. Find the value of $3\cdot 45$ of 5 guineas.

5. A purse and money are worth $\frac{19}{30}$ £, and the money is seven times the value of the purse; how much is in it?

6. If a sheep is worth £1 5*s.* $3\frac{3}{4}$*d.*, how many can I buy for £102 10*s.* $3\frac{3}{4}$*d.*? If I lose four and sell the rest at 13 half-crowns a head, what do I gain?

7. Add together $\frac{5}{8}$ of three half-crowns, $\cdot 7$ of a £, and $\cdot 25$ of a guinea. Find the exact value of $\cdot 5\dot{1}\dot{8}$ of half a sovereign.

8. How many square yards of carpet will cover the floor of a room, 16 ft. 8 in. long and 13 ft. 5 in. broad, leaving the hearth-stone, which is 3 ft. 11 in. long and 1 ft. 7 in. broad, uncovered?

9. Extract the square root of 41605800625, and the cube root of $69426\cdot 531$.

10. Define interest and discount. Point out which is the greater of the two, and why? How many years purchase should be paid for a freehold property to clear $4\frac{1}{2}$ per cent.?

11. What sum must be given for £1500 stock in the 3 per cents. at $94\frac{1}{8}$? and what will be gained by selling out after the price has risen $\frac{3}{8}$?

12. What is 20° Centigrade in Fahrenheit's scale; and what of the Centigrade corresponds to 77° of Fahrenheit?

13. Required the values of each of the following quantities to five places of decimals:—

$$\frac{1}{10 + \frac{1}{2 + \frac{1}{30}}} \; ; \quad \frac{1}{2\left\{\frac{9}{11} + \frac{1}{3}\left(\frac{9}{11}\right)^3 + \frac{1}{5}\left(\frac{9}{11}\right)^5\right\}}$$

14. If one rectangle has its adjacent sides 3 ft., and 10 ft. and another 3 ft. and 5 ft., what is the ratio of the rectangles?

15. Give the rule for proving a sum in addition by "casting out the nines," and illustrate it by an example.

16. If 40 men, working 24 days of 8 hours, can build a wall, how many days of 10 hours long will 980 boys require? it being known that, whilst 12 boys can build a cubic yard, 5 men can build $\frac{1}{5}$ of $\frac{2\frac{1}{2}}{\cdot 06}$ of a pillar 12 ft. high, with a square base whose breadth is $1\frac{1}{2}$ ft.

## Ex. 106.

1. The product is 154923000, and multiplicand 42375; what is the multiplier? Write down a prime number and a composite number.

2. How many boxes of raisins, each weighing 24 lbs. 8 oz., can be filled out of 3 tons 17 cwt.?

3. Reduce 138600 inches to miles. How many minutes are there in the month of February in Leap-year?

4. My daily expenses are 10*s.* $11\frac{3}{4}$*d.*; how much can I save out of an income of 200 guineas?

5. Add the product of 2·83 by·013 to the quotient of 9·6195 by 1·21. Reduce $\frac{1}{\cdot 2}$ nails to the decimal of a yard.

6. Simplify $(137641)^{\frac{1}{2}} + \frac{6\cdot 37}{\cdot 013} \times \frac{1}{\cdot 009}$. Find the value in shillings and pence of ·4390625 of £2. Divide 516 by 0·0016.

7. If 12 lbs. of tea cost £2 17*s.*, how much may be bought for £26 12*s.*? Find also (by Practice) the cost of 3206 articles at 16*s.* $10\frac{1}{2}$*d.* each.

8. A bookseller allows 25 per cent. on books sold. Supposing him to receive £16 17*s.* 6*d.* for books whose cost price is 2*s.* each, how many copies does he sell?

9. Find by duodecimals the height of a parallelopiped, which contains 659 ft. 1248 ins., and whose base is 26 ft. 6 ins.

10. If the rate of interest be 15 per cent. per annum, what is the discount on £1 for one year?

11. Supposing a pound of silver to be worth £3 6*s.*, what is the price of a salver weighing 7 lb. 3 oz. 10 dwt. subject to a duty of 1·5*s.* per oz, and an additional charge of $1\frac{5}{8}$*s.* per oz. for the workmanship?

12. If a person invests in the 3 per cent. consols, when they are at 90, what rate of interest does he receive on the purchase-money, and what ought to be the price of the $3\frac{1}{4}$ per cents. in order that a purchaser may receive the same rate of interest?

13. On what principle may the equated time of paying two sums due at different times be found? Is the common rule for working such examples strictly correct?

14. Two men start from the same place; the one due north, the other

due east. If the former go 7 miles a day, and the latter 15, how far distant are they from each other at the end of nine days?

15. Supposing a lever 12 inches long, with weights of 4 lbs. and 20 lbs. at the ends, where will the fulcrum be? If the end of a straight lever, 4 ft. long, be supported on a fulcrum, and a weight of 20 lbs. be suspended at $1\frac{1}{2}$ ft. from that end, find the force at the other end.

16. There are in a manufactory a certain number of workmen who receive 60*s.* a week, twice as many who receive 31*s.* 6*d.* a week, and eleven times as many who receive 14*s.* a week; and the total amount of wages for one week is £96 19*s.* Find the number of workmen.

## Ex. 107.

1. If a man walk 3 hours a day, and 3 miles an hour, how long would he be walking a distance equal to the earth's circumference, or 25002 miles?

2. Explain the operation called "Long Division," and divide 56 millions, 831 thousand, seven hundred and twenty-nine by 7323.

3. Define a "fraction," a "vulgar fraction," and a "decimal fraction," and show how to compare the values of two different fractions. Which is the greater, $\frac{5}{7}$ of $1\frac{3}{4}$ or $\frac{1}{3}$ of $3\frac{3}{8}$? by how much?

4. Reduce 7 cwt. 13 lbs. to ounces; one million grains of gold to pounds, &c., and 3 lbs. 8 oz. Av. to Troy weight.

5. Explain how the value of a decimal is affected by removing the decimal point any number of places either to the right or to the left, or by affixing and prefixing ciphers.

6. Multiply ·0017 by 700, and divide 670 by ·0015. Find decimal fractions corresponding to $\frac{77}{27}$ and $\frac{5}{14}$. Reduce $\frac{3}{20}$ of half a crown to the decimal of £5.

7. A field, 300 yards long and 280 broad, was ploughed by 6 horses in 2 days of 8 hours each; how many horses will plough a piece of ground 500 yards long and 315 broad in 3 days of 10 hours each?

8. Reduce 1·074 roods to the decimal of an acre. What fractional part of a hogshead of wine is $\frac{11}{18}$ of a gallon? Find the value of ·04535 miles.

9. Find the square root of 75·347 and of 7·1 to four places of decimals. What is the area of a square whose side is 3725 links?

10. What ready money will discharge a debt of £413 10*s.* due 9 months hence at $4\frac{1}{2}$ per cent. per annum? Show that the discount is equal to the interest of the present worth.

11. Find the difference between the weight of half a crown and half

an ounce avoirdupois; the pound Troy of silver being coined into 66 shillings.

12. Show that the triangle whose sides are 3, 4, 5 is a right-angled triangle. What other numbers would satisfy this condition?

13. Find the weight of a cubic inch of glass whose specific gravity is 3·456, the weight of a cubic foot of water being 1000 ounces.

14. The premium on a policy of assurance for £2000 is £55 15*s*. At the end of 5 years an abatement of 52½ per cent. is made on all policies. What now will be the annual premium?

15. A jeweller sold jewels to the value of £1200 for which he received 876 pistoles at ·825£ each, and £77 3 fl. in money. What sum remains unpaid?

16. If the 3 per cents. are at 95, and Government offer to receive tenders for a loan of 5 millions; the lender to receive 5 millions in the 3 per cents. with a certain sum in the $3\frac{1}{4}$ per cents., what sum in the $3\frac{1}{4}$ per cents. ought the lender to accept?

## Ex. 108.

1. If you should add 28 together a hundred and twenty times, to how much would it amount? If you should repeatedly take away 21 from this amount, how many times could it be done?

2. Supposing a Napoleon worth 15*s*. 11*d*., find the value of £20 in Napoleons and francs. How many days are there between June 17, 1855, and Dec. 25, 1856?

3. In the fraction $\frac{5}{8}$, name the two parts and explain what they signify. What is a compound fraction? Why is it that when the denominator is doubled, the fraction becomes of only half the value?

4. Reduce to their simplest forms, $\dfrac{4\frac{1}{3} \text{ of } 3 - 3\frac{1}{4} \text{ of } 3\frac{1}{3}}{4\frac{1}{4} - 3\frac{1}{3}} \div \left\{ 6\frac{1}{2} \text{ of } \dfrac{\frac{1}{3\frac{1}{3}} + \frac{1}{2\frac{1}{2}}}{3\frac{1}{3} - 2\frac{1}{4}} \right\}$; and $\dfrac{1\frac{1}{4} - \frac{5}{12}}{1\frac{1}{4} + \frac{5}{12}} + \frac{7}{6} \text{ of } \dfrac{9 \times 5}{14 \times 3} - \dfrac{11\frac{1}{4}}{15}$.

5. A sum of 940 6*s*. 8*d*. is offered as a composition for debts to the amount of £1072; how much is this in the pound?

6. In a "bumping" race, the second boat gains 5 inches on the first at every stroke, and bumps it after 156 strokes. What was the distance between them at starting?

7. Add the quotient of 58546·73 by ·23141 to the square root of 16·4025. Find the value of 2·15 of 10*s*.

8. Reduce 13 weeks $5\frac{1}{4}$ days to the decimal of 365·25 days, correct

to four places; and express in the form of a circulating decimal the difference between ·1 and ·100.

9. If 6 men dig a piece of ground 15 yards long and 8 broad in 3 days, working 12 hours a day; how many hours a day must 9 men work, to finish a piece 20 yards long, and 10 broad in 4 days?

10. There are four sorts of tea at 16*s.* 14*s.* 9*s.* and 8*s.* per lb. How many pounds must be taken from each to make a mixture worth 10*s.* per lb.?

11. Find the compound interest of £204 5*s.* for 3 years at $4\frac{1}{2}$ per cent. How can these sums be done when interest is required for a large number of years?

12. A merchant bought 100 yards of velvet for £112; at what rate per yard must he sell it so as to gain as much by the whole quantity as four yards are sold for?

13. Twenty-four puncheons of rum, worth 4*s.* 9*d.* per gallon, are exchanged for 150 guineas and 714 yards of cloth. What is the cloth worth per yard?

14. Having given the logs. of 15 and 16, find that of 27.

15. A tradesman increased his capital $\frac{1}{4}$th annually, and at the end of three years it amounted to £2441 8*s.* $1\frac{1}{2}$*d.*, what sum did he begin with?

16. After paying a poor-rate, and also the income-tax, a person had £486 left. The poor rate amounted to £22 10*s.* more than the income-tax. If the original income was £540, find the number of pence per pound in the income-tax and in the poor-rate.

## Ex. 109.

1. Express in figures twenty millions, three thousand and five; and in words the number 120602. Simplify $(119-68) - (209 - 89) + (19 \times 11) - (1444 \div 38)$.

2. Subtract one farthing from ten pounds, and explain the operation. Divide £11 11*s.* 11*d.* by 23. How many times is $4\frac{3}{4}$ contained in 114?

3. Add together $\frac{3}{7}$ of $\frac{4}{5}$ of $1\frac{1}{3}$, $\frac{7}{8}$ of $\frac{11}{12}$ of $3\frac{1}{4}$, and $30\frac{4}{5}$; and reduce to a simple fraction in its lowest terms $\dfrac{1\frac{1}{4} \times 1\frac{1}{4} \times 1\frac{1}{4} - \frac{1}{3}}{1\frac{1}{4} \times 1\frac{1}{4} + \frac{3}{8}}$.

4. Find the area of a four-sided field, two of whose sides are parallel, their length 230 and 480 yards, and their distance 200 yards.

5. A wheel makes 547 revolutions in travelling 1 mile, 1 furlong, 25 yards, 2 ft.; what is its circumference?

6. Find the price of 15 qrs. 5 bush. 2 pecks of wheat at 8*s.* 9*d.* a bushel. What is the dividend on £171 14*s.* 6*d.* at 13*s.* $4\frac{1}{2}$*d.* in the pound.

7. Supposing the sides of a right angled triangle to be 30 ft. and 40 ft., find the hypothenuse.

8. Simplify $\frac{49{\cdot}2}{{\cdot}0025} \times \frac{{\cdot}0224}{25{\cdot}6}$. Find the sum of 1·05 of a crown, ·714285 of a guinea, and ·16 of 6*s.* 8*d.*

9. If £240 be paid for bread sufficient to serve 49 persons for 18 months, when wheat is 48*s.* per quarter; how long will £235 find bread for 92 persons, when it is 56*s.* per quarter?

10. How many paving-stones, each of them a foot long and $\frac{4}{15}$ of a foot broad, will be required to pave a street 45 ft. wide surrounding a square the side of which is 255 ft.

11. Prove the rules for pointing off in the multiplication and division of decimal fractions. If an integer is divided by a decimal, will the quotient contain integers?

12. A sum of money at simple interest has in $4\frac{1}{2}$ years amounted to £735, the rate of interest being 5 per cent. per annum; what was the sum at first?

13. If £533 6*s.* 8*d.* be received as present payment for £560 due two years hence, at what rate per cent. is discount calculated?

14. Find the least number of ounces of standard gold that can be coined into an exact number of half-sovereigns: — standard gold being coined at the rate of £3 17*s.* $10\frac{1}{2}$*d.* to an ounce.

15. Divide £4 6*s.* between 28 men, 25 women, and 7 children, so that 4 men may have as much as 3 women, and 4 women as much as 5 children.

16. If the commission on purchasing stock is $\frac{1}{8}$ per cent. on the stock purchased, what ought to be the price of the 3 per cents. when the $3\frac{1}{2}$ per cents. are at $89\frac{7}{8}$, in order that an equal income may arise from investing the same sum of money in either? What ought to be the price, if the commission were $\frac{1}{8}$ per cent. on the money invested?

## Ex. 110.

1. Explain the meaning of the words "Integer," "Prime," "Root," "Power," "Reciprocal," "Surd."

Find the number of square inches in an acre; and the number of hogsheads, &c., in 9635 pints of wine.

2. What is the cost of 5736 lbs. at 3*s.* $8\frac{1}{2}$*d.* per lb.; and of 5 ac. 3r. 10 p. at £47 13*s.* per acre.

3. There is a plantation in the form of a hollow square. The length of each side externally is 252 yards, and the breadth of each side is 16 yards; find the area of the plantation.

4. Express as a simple fraction $\frac{2\frac{1}{2}+3\frac{1}{2}}{\frac{3}{5}\text{ of }10\frac{1}{2}}$, and show that $\left(1+\frac{1+\frac{1}{3}}{3}\right) \div \left(1+\frac{1}{3+\frac{1}{3}}\right) \times \left(1-\frac{1}{3+\frac{1}{3}}\right) \div \left(1-\frac{1-\frac{1}{3}}{3}\right) = 1$.

5. Add together $\frac{8}{11}$ of a pole, $\frac{3}{4}$ of a yard, and $\frac{7}{15}$ of an English ell. Compare the values of $\frac{5}{7}$ of a guinea, and $\frac{7}{8}$ of £1, as fractions of £5; and reduce 19 ft. 7 in. to the fraction of a mile.

6. If 37 cwt. $2\frac{1}{2}$ qrs. cost £283 11*s.* $11\frac{5}{7}$*d.*, how much will £7 10*s.* 9*d.* buy? What is the first term of the proportion, 6, 3, 9?

7. Explain the principle of the common system of numerical notation. Why is it more convenient to have a composite than a prime number for the radix of a system?

8. Divide 15 by 6·25, and 17·28 by 0·0144. Reduce $3\frac{1}{2}$ of £1 3*s.* 4*d.* to the decimal of £100. What decimal of a crown is equal to a groat?

9. If 5 men and 7 boys can reap a field of corn of 125 acres in 15 days, in how many days will 10 men and 3 boys reap a field of 75 acres, each boy's work being $\frac{1}{3}$ of a man's?

10. The diagonal of a cube is 25 inches; find the number of inches in an edge to three places of decimals.

11. Supposing the circumference : diameter :: 3·14159 : 1, find the diameter of a cylinder whose circumference is 14 ft. $11\frac{1}{2}$ ins.

12. A piece of land of 200 acres is to be divided among 4 persons in proportion to their rentals. Supposing these rents to be £500, £350, £800, and £90, how many acres must be allotted to each?

13. How much more income will a person have by converting £3975 of 3 per cent. stock into $3\frac{1}{2}$ per cent. stock: the former being at $93\frac{3}{4}$, and the latter at $99\frac{3}{8}$?

14. Find the true discount upon a bill of £587 8*s.* 11*d.*, drawn Feb. 29th, at 3 months, discounted April 30th, at $3\frac{3}{4}$ per cent., allowing three "days of grace."

15. A reservoir is 24 ft. 8 in. long, and 12 ft. 9 in. wide; how many cubic feet of water must be drawn off to make the surface sink 1 foot?

16. Three men bought a grindstone, the axle-hole measuring 4 inches across, and the radius of the grindstone being 14 inches. A. pays 3*s.* 6*d.*, B. 4*s.* 6*d.*, and C. 5*s.* 6*d.* How much of the radius must each grind down for his share? measuring from the inside.

## Ex. 111.

1. A stationer buys 72 reams of paper at 15*s.* per ream, and 48 at 17*s.* 6*d.*; find his entire outlay, and the average price per quire.

2. A cellar is to be dug, whose length, breadth, and depth are each 10 ft. 4 in. How many solid feet does it contain, and what will be the cost of digging it at 1*s.* per yard?

3. If an income tax of 10*d.* in the pound amounts to $2\frac{1}{2}$ millions; what must be the poundage in order to produce £3,375,000?

4. Having given that 125 Italian lire make 23 Roman scudi, and that 2001 Roman scudi make 12500 Austrian zwanzigers, find how many Italian lire make 100 Austrian zwanzigers.

5. Find the fraction that 15*s.* $6\frac{3}{4}$*d.* is of £25; reduce 2 miles 2 furlongs 115 yards to the decimal of 5 leagues, and 291 pints to the decimal of a hogshead (beer).

6. Multiply $\frac{1}{2}$ of $\frac{2}{3}$ of $5\frac{3}{8}$, $\frac{17\frac{1}{8}}{94}$, $\frac{14}{95\frac{3}{8}}$, and $\frac{5}{8}$ of 17 together, for the numerator of a fraction; and $\frac{14\frac{5}{8}}{17\frac{3}{8}}$, $\frac{4}{\frac{7}{6}}$, $\frac{\frac{7}{11}}{15\frac{1}{2}}$, and $51\frac{5}{8}$ for a denominator; and reduce the new fraction to its proper terms.

7. Find the area of a parallelogram, whose base is $5\frac{1}{2}$ feet, and height 4 feet.

8. Multiply 30·05 by 123·4, and divide 174·924 by 135600. What is the value of 0·12 of £3 7*s.* 6*d.*? In what place will the first significant decimal digit be in the quotient of ·0063 by 40·5, 40·5 by ·0063, and 7354 by 1290·005?

9. What is the value of a 3, standing in the third place of decimals? What is a circulating or recurring decimal? Prove the rule for pointing off decimals in extracting the square root of a number.

10. Find the amount accumulated at the end of three years by one who invests £200 now, and does the same at the beginning of each succeeding year, at $3\frac{1}{4}$ per cent. compound interest on the whole sum invested.

11. The prime cost of 38 gallons of wine is £25, and 8 gallons are lost by leakage. At what price per gallon should the remainder be sold to gain 10 per cent. on the outlay?

12. If 433·5 grains of flint-glass weigh 343·5 grains in water, what is the specific gravity of flint-glass?

13. Show that $\frac{8}{\sqrt{2}} = 5{\cdot}6568$ nearly. Subtract the square root of $1\frac{25}{144}$ from the square root of 8281.

14. By the reduction of the income tax from 7*d.* to 5*d.*, a person saves £28 2. 6*d.* a year; what is his income?

15. Bills on Amsterdam, bought in London at 12 florins 15 cents. per £ sterling, are sold in Paris at $57\frac{1}{2}$ florins for 120 francs: — what is the rate of exchange between London and Paris?

16. A railway company declared an annual dividend of 18*s.* per share. This paid exactly 3 per cent. on the original shares; what were the shares? If a man buys in at 20, what real interest does he get for his money?

## Ex. 112.

1. Write down in *figures* the number, six hundred two millions, two hundred ten thousand, five hundred; and write in *words* the number 201900790. Find the G. C. M. of 8721 and 11799.

2. The Commonwealth ended 29th May, 1660; having lasted 11 y. 3 m. 29 d. When did it begin?

3. Reduce to a simple fraction $394\frac{74}{99} \div 894\frac{547}{719}$. What number multiplied by $\frac{2}{3} = \frac{1}{4}$? Explain the object and process of reducing fractions to a common denominator. Reduce to L. C. D. $\frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{9}$.

4. What fraction of an acre is 2 roods 15 perches? Find the value of $\frac{4}{7}$ quarters of corn; and add $\frac{3}{5}$ of a league to 1 f. 24 p.

5. Reduce 3 lb. 8 oz. to the decimal of a ton. How much must be subtracted from $\frac{3}{11}$ of a beer butt to leave 29 gallons?

6. If 100 grades = 90 degrees, find the number of grades in 33° 26′ 8″, and the number of degrees in $12\frac{1}{2}$ grades.

7. Find the side of a square whose area = that of a rectangle, whose sides are 47·14 and 210 yards.

8. The price of a book containing 90 examples of 8 questions each is 2*s.* What ought to be the price when 20 examples are added of 16 questions each.

9. Explain the rule for pointing in the extraction of the cube root of a decimal. What are the square roots of ·9 and ·1?

10. A piece of gold at £3 17*s.* $10\frac{1}{2}d.$ per oz. is worth £151 17*s.* $1\frac{1}{2}d.$; what will be the worth of a piece of silver of equal weight at 54*s.* 6*d.* per lb.?

11. If by selling goods at 2*s.* 3*d.* per lb. I gain cent. per cent., what shall I gain per cent. by selling them for 9 guineas per cwt.?

12. A wall is to be built 15 yards long, 7 feet high, and 13 inches thick, containing a doorway 6 feet high and 4 feet wide. How many bricks will it require, the solid content of a brick being 108 cubic inches?

13. Reduce 12345654321 to the duodenary scale, and 1828 to the septenary.

14. The top of a may-pole, being broken off by a blast of wind, struck the ground at 10 feet distance from the foot of the pole; what was the height of the whole may-pole, supposing the length of the broken piece to be 26 feet?

15. A. and B. agree to divide their travelling expenses in the proportion of the numbers 5 and 7. A. pays in the whole £25 16*s.*, and B. £15 17*s.* What has the one to pay and the other to receive in order to settle the account?

16. If A. can do as much work in 5 hours as B. can do in 6, or as C. can do in 9, how long will it take A. to finish a piece of work, half of which has been done by B. working 9, and C. 24 hours?

## Ex. 113.

1. In multiplying and dividing point out any methods of testing the correctness of your results. Multiply 1 yd. 2 ft. $7\frac{1}{4}$ in. by 28; and divide 753 cwt. 3 qrs. by 210.

2. Reduce 3402 ten-penny pieces to guineas, and £14 17*s.* 6*d.* to half-crowns. Find the number of seconds in January, February, and March, 1857.

3. How is a fraction written? What is a mixed number? Add $198\frac{1}{2}$ to $802\frac{1}{3}$, and subtract $77\frac{31}{42}$ from 89. Reduce $\frac{297}{6372}$ to its lowest terms.

4. Find the value of $\frac{1}{2}+\frac{1}{12}-\frac{5}{9}+\frac{5}{36}$. Reduce $\frac{4}{5}$ of half-a-crown to the fraction of 6*s.* 8*d.*; and multiply 1 A. 2 R. 24 P. by $15\frac{5}{8}$.

5. Divide 16·9 by ·013, and also multiply them together. Put $\frac{7}{101}$ into the form of a circulating decimal.

6. A person travels 8 hours a day and performs 180 miles in 3 days; how long would he be performing 630 miles, if he travelled 7 hours a day?

7. A fraction whose numerator is 10582, and denominator 37037, is equal to another fraction, whose numerator is 2886. What is the denominator of the latter fraction?

8. If a decimal system of coinage were adopted, and the tenth, hundredth, and thousandth part of a pound sterling, called respectively florins, cents, and mils; what sum would 4 florins, 7 cents, 5 mils represent?

9. Find the squares of 1039681 and 328776. In dividing the greater result by the less, what will be the first significant digit in the decimal places? In what place will it stand?

10. A castle is 45 yards high, and is surrounded with a ditch 60 yards

broad; how long must a rope be to reach from this side the ditch to the top of the castle?

11. Define present value. What sum will amount to £820 16*s.* in $3\frac{1}{2}$ years, at 4 per cent. simple interest? What amount of stock in the 3 per cents. will give an income of £150?

12. Find the thickness of a solid whose length is two yards, breadth a yard and a half, and solid content 1 cubic yard, 6 cubic feet, and 1296 cubic inches.

13. Shew that arithmetical *multiplication* and *division* are shortened *addition* and *subtraction* respectively. How is it that we do not alter the value of a *decimal* fraction by bringing down any number of ciphers to the right hand of the last figure?

14. A merchant has teas worth 5*s.* and 3*s.* 6*d.* per lb. respectively, which he mixes in the proportion of 2 lbs. of the latter to one of the former. How much will he gain or lose per cent. by selling the mixture at 4*s.* 6*d.* per lb.?

15. A man buys 1260 quarters of corn, one-fifth of which he sells at a gain of 5 per cent., one-third at a gain of 8 per cent., and the remainder at a gain of 12 per cent.; if he had sold the whole at a gain of 10 per cent., he would have obtained £22 13*s.* more: what was the cost price per quarter?

16. A box whose outer dimensions are 2 ft. 6 in. long, and 1 ft. 10 in. broad, and 1 ft. high, is to be made of board 1 in. thick; how many square feet of board will be requisite?

## Ex. 114.

1. Prove that 5 times 27 = 27 times 5, and that $\frac{1}{8}$ of $3 = \frac{3}{8}$ of 1. Find the quotient and remainder resulting from the division of 456072 by 47.

2. Nine rupees, six crown pieces, and eleven threepenny pieces amount to £2 13*s.* What is the value of a rupee? and of a lac?

3. Subtract 1 florin, 4 cents, from 7 florins, 1 cent, 5 mils, and shew that eight times the difference equals £4 12*s.*

4. Reduce £65 12*s.* 6*d.* to the decimal of £125; and find the values of ·475 of £128, and $\frac{1}{8}$ of $\frac{7}{8}$ of $\frac{12}{13}$ of $\frac{3}{14}$ of £2 12*s.*

5. Multiply and divide $\frac{2}{3} + \frac{1}{7}$ by $1 - \frac{1}{13}$. Find which result is the greater, and express their difference in its lowest terms.

6. What fraction of 5*s.* is 2*s.* 3*d.*? Reduce the result to a decimal. If $1\frac{3}{8}$ of a sum of money $= \frac{3}{7}$ of 5*s.* 10*d.*, find the sum.

7. What must be the rate of interest in order that the discount on £2849, payable at the end of 1 year 73 days, may be £99?

8. When the 3 per cents. are at $92\frac{3}{8}$, how much stock must be sold

out to pay a bill of £715 17*s.*, due 9 months hence at 4 per cent. simple interest?

9. When are four quantities said to be in proportion? Shew by means of your definition that £191 12*s.* 6*d.* : £31 10*s.* :: 365 days : 60 days; and *deduce* the method of working the following question:— "If 3 workmen earn between them £191 12*s.* 6*d.* in a year, in what time would they earn £31 10*s.*?"

10. Find the area of a room 8 ft. 4 in. long by 12 ft. 2 in. broad, by duodecimals or cross multiplication. If in this example the room were not supposed to be a *rectangular* parallelogram, how would the answer have to be interpreted?

11. What sum must A. bequeath to B. so that B. may receive £1000 after a legacy duty of £10 per cent. has been deducted?

12. Given that the square of 15334 = 235131556; find that of 153347, without going through the operation of squaring.

13. A pound of silver is coined into 66 shillings, of which 62 only are issued. If nineteen half-crowns and fifteen sixpences are melted into bullion, and sent to the mint to be recoined, what sum will be re-issued?

14. If one watch loses and another gains at the rate of a minute a day, and they are both set at noon on Monday, what time will be indicated by the latter when the former points to 10 h. $49\frac{1}{11}$ min. P.M. on the following Saturday?

15. If 20 men can perform a piece of work in 12 days, how many men will perform a piece of work half as large again in a fifth part of the time, if they work the same number of hours a day; supposing that two of the second set can do as much work in an hour as three of the first set?

16. The distance from London to Cambridge is $57\frac{1}{2}$ miles, and from Yarmouth to Norwich, $20\frac{1}{2}$. The second-class fares between the same places are 11*s.* and 2*s.* respectively; what would have to be added to the present fare per mile (second-class) between Cambridge and London, so as to make it exactly double the second-class fare per mile between Yarmouth and Norwich?

## Ex. 118.

1. Explain our decimal system of Arithmetic, and how it is that we are enabled, with a few digits and a cipher, to express any number however great.

2. If the carriage of 12 cwt. 14 lb. amount to £1 4*s.* 3*d.*, how much is that per ton? Four cwt. are carried 52 miles for £1 2*s.* $6\frac{1}{2}$*d.*, how many lbs. can be carried 13 miles for the same sum?

3. An article which costs 6*s.* 8*d.* is sold for 8*s.* $10\frac{3}{4}$*d.*, what is the profit on £100? Apply the "Rule of Practice" to this example. What is meant by "aliquot parts?"

4. Reduce $\frac{2\frac{3}{4}-1\frac{2}{5}}{\frac{19}{36}+\frac{3}{8}\text{ of }\frac{1}{4}} \div 1\frac{9}{15}$, and $\frac{3\frac{1}{2}-2\frac{1}{6}}{\frac{1}{4}\text{ of }(\frac{1}{6}+\frac{1}{7})} + 15\frac{5}{9}$ to their simplest forms. Is a fraction increased or diminished by adding the same number to its numerator and denominator? Give an example.

5. Reduce 2*s.* 6*d.* to the fraction of $\frac{5}{12}$ of £1, and of £1000 respectively. Find the value of ·875 of 15*s.* 6*d.*, and reduce $\cfrac{3}{4+\cfrac{5}{6+\cfrac{7}{8+\cfrac{9}{10}}}}$ to the simplest single fraction.

6. Divide 12·55 by ·01004; 1255 by 10·04; and ·001255 by 1004. Express $101\frac{3}{8}$, $\frac{7}{25}$, $4\frac{1}{2000}$ as decimals, and then add them together.

7. Express as vulgar fractions in their lowest terms $\frac{5}{7}$ of ·375, and ·285714. Multiply the difference between 75 hundredths and 5 tenths by 8 thousandths, expressing the result as a vulgar fraction.

8. Show that the interest obtained by investing a sum of money in the 3 per cents. at $82\frac{1}{2}$, is to the interest obtained by investing the same sum in the $3\frac{1}{2}$ per cents. at $93\frac{1}{2}$, as 34 to 35.

9. If $2\frac{2}{3}$ of B = $1\frac{1}{2}$ of (A + $\frac{3}{4}$ of A), find two whole numbers which shall bear to each other the ratio of A to B.

10. Given that the square root of 105625 is 325, find that of 10582009.

11. If a certain number of workmen can do a piece of work in 25 days, in what time will $1\frac{2}{3}$ of that number of men do a piece of work twice as great, supposing that two of the first set can do as much work in an hour as three of the second set can in $1\frac{1}{2}$ hours, and that the second set work half as long a day as the first set?

12. In how many years will £1000 amount to £1123 12*s.* at 6 per cent. compound interest? What would it amount to in 5 years at the same rate at simple interest?

13. A person invests £1365 in the 3 per cents. at 91; he sells out £1000 stock when they have risen to $93\frac{1}{2}$, and the remainder when they have fallen to 85. How much does he gain or lose by the transaction? If he invests the produce in $4\frac{1}{2}$ per cents. at 102, what is the difference in his income?

14. At what time between the hours of 1 and 2 will the hands of a watch be (1) at right angles to each other, (2) coincident with, (3) opposite to, each other?

15. Find the amount of £746 8*s.* 6*d.* for $4\frac{3}{4}$ years at $6\frac{1}{2}$ per cent. simple interest; and the present value of £500 due two years hence, allowing $3\frac{1}{2}$ per cent. compound interest.

16. Two men start at the same time from the same point, and in opposite directions, to run *twice* round a field, the circuit of which is a $\frac{1}{4}$ of a mile. Their speeds are respectively 7 and 8 miles an hour. Find where they will meet.

## Ex. 116.

1. Define "multiplication," and multiply 5102 by 31, explaining clearly each step of the process and its reason, and deduce the usual rule. Multiply £721 0*s.* 5$\frac{1}{2}$*d.* by 96, and divide 1283 cwt. 4 lbs. by 75.

2. Reduce $\frac{3}{7}$ of £1 to the fraction of 1$\frac{1}{8}$ of £3 5*s.* What fraction is 1*s.* 6$\frac{1}{2}$*d.* of 2*s.* 5*d.*? and 5$\frac{1}{4}$ of 4$\frac{1}{8}$?

3. Find the value of ·375 of a guinea; and reduce 4*s.* 7$\frac{1}{2}$*d.* to the decimal of 0·01 of £1. Convert into a vulgar fraction in its lowest terms the sum of 9 tenths, 3 hundredths, and 5 thousandths.

4. After paying an income-tax of 10 per cent., a person has £1250 a year, what was his entire income?

5. Extract the cube root of 0·01 and ·5 to three places of decimals.

6. When is one quantity said to vary directly, and when inversely, as another? One horse takes 6 strides while another takes 5, but 7 strides of the latter horse are equal to 8 strides of the former; which is the swifter horse?

7. Divide £2 12*s.* 3*d.* by 1*s.* 4$\frac{1}{2}$*d.* Find a sum of money which shall be the same fraction of £61 9*s.* that 2 cwt. 2 qrs. 10 lbs. is of 36 cwt. 1 qr.

8. Add together $\frac{1}{2}$ of 2*s.* 6$\frac{3}{4}$*d.*, $\frac{1}{3}$ of £3 2*s.* 6$\frac{1}{4}$*d.*, and $\frac{1}{8}$ of £5 7*s.* 3$\frac{1}{4}$*d.* If A. be 2$\frac{2}{3}$ of B., and B. 1$\frac{3}{8}$ of C., and D. be 7$\frac{1}{3}$ of C., what fraction is A. of D.? What is meant by "reducing one quantity to the fraction of another?"

9. Reduce $(\frac{3}{25}$ of $2{\cdot}45 - \frac{1}{100}$ of $\cdot 02) \div 1000$, and $(\frac{5}{80}$ of $11{\cdot}02 \sim \frac{3}{50}$ of $11{\cdot}8) \times 0{\cdot}1$ to decimals. What decimal of a guinea is equivalent to ·2835 of a pound sterling?

10. The four quantities, 1 lb. 4 oz., £23 16*s.* 3*d.*, £19 1*s.*, and 1 lb. 9 oz. taken in a certain order are in proportion, prove that they are so by means of your definition of proportion. What are *concrete* quantities? Can 1 lb. 4 oz. be multiplied by £19 1*s.*?

11. A has $\frac{3}{11}$ share in a concern, and sells $\frac{1}{5}$ of $\frac{5}{6}$ of his share for £500; what is the value of $\frac{1}{11}$ of $\frac{1}{12}$ of the concern.

12. If the population of Europe be 227 million 700 thousand, and the number of square miles 224 millions less; what is the average population per square mile?

13. If the sum of £1200 be put out at 10 per cent. per annum compound interest, and interest paid half-yearly, to what will it amount in a year and a half?

14. What sum must a person invest in the 3 per cents. at 90, in order that by selling out £1000 stock, when they have risen to $93\frac{1}{2}$, and the remainder when they have fallen to $84\frac{1}{4}$, he may gain £6 5*s.* by the transaction?

15. A person rows from A. to B. (a distance of a mile and a half) and back again in an hour; how long would it have taken him if he had "pulled" equally hard, and there had been a stream of $1\frac{1}{2}$ miles an hour flowing from A. towards B?

16. Easter Sunday is always the Sunday directly *following* the *first* full moon which falls *after* March 20th; there was a full moon on March 21st 1856 (a *Friday*); February in 1856 has 29 days, being a "leap year." Find from these data when Easter Sunday fell in 1854.

## Ex. 117.

1. A vessel containing 384 gallons is filled by 3 pipes. The 1st and 2nd together fill it in 32′; the 1st and 3rd in 24′; the 2nd and 3rd in 16′. How many gallons does each pipe discharge in a minute?

2. If 4 men fire a gun 48 times, and 5 men 52 times in a hour; how much more time will be required for firing 21,216 shots from 26 guns, when there are 4 men to a gun than when there are 5?

3. How long would a column of men, 3000 feet long, take to march through a defile of $\frac{3}{4}$ of a mile at the rate of 75 paces of $2\frac{3}{4}$ feet each per minute.

4. If a ball falling from rest drop through a space of $64\frac{3}{8}$ ft. in 2″ through what distance will it drop in 3″ (space varies as the square of the time)?

5. What sum would be saved annually, if the interest on a public debt of £4,000,000 were reduced from $3\frac{1}{2}$ per cent to 3 per cent? If in consequence the price of this stock fell from £101 to $95\frac{3}{8}$, how much would the whole property of the fundholders be diminished?

6. Show that a fraction whose denominator is less than ten, cannot when reduced to the decimal form contain the figure 9 in its decimal part.

7. The advance of the hour-hand of a watch beyond the minute-hand is measured by $15\frac{3}{5}$ of the minute divisions, and it is between nine and ten o'clock; find the exact time indicated by the watch.

8. In a manufactory there are employed 3 foremen at $\frac{1}{6}$£ per day, eighteen times as many workmen at 2·25*s.*, and seven times as many boys at $1\frac{1}{2}$*s.* How much has the master to pay in wages per week?

9. A person is desirous of exchanging 25 Spanish £100 bonds, and £550 $3\frac{1}{2}$ per cent. stock, for 3 per cent consols. The prices of the securities are 31, 99, $91\frac{3}{8}$ respectively. What quantity of consols can he obtain?

10. A. leaves $\frac{1}{3}$ of his property to his wife, $\frac{1}{3}$ to his son, and $\frac{1}{6}$ to his daughter. The wife at her death leaves $\frac{3}{5}$ of her legacy to the son, who then adds his fortune to that of his sister, and divides the whole with his sister in the proportion of 3 : 1. What proportion of the whole property does the sister gain by the arrangement?

11. A bankrupt has good debts to the amount of £456 18*s.* 1*d.*; and the following bad debts, £360 7*s.* 10*d.*, £120 13*s.*, £19 18*s.*, for which he receives respectively 4, 5, and 9 shillings in the pound. His own liabilities amount to £3050. How much can he pay in the pound?

12. A. and B. are two places distant from each other 26 miles. A person leaves A., walking 5 miles an hour, to meet another coming from B., walking $3\frac{1}{3}$ miles an hour. How long must the former start after the latter that they may meet 8 miles from A.?

13. A person sells out of the 3 per cent. consols at $91\frac{1}{3}$ £700 stock. After consols have fallen $2\frac{1}{2}$ per cent., he buys in again with the same money. What difference will thus be made in his annual income?

14. A manufacturer employs 50 men and 35 boys, who respectively work 12 and 8 hours per day during 5 days of the week, and half time on the remaining day. Each man receives 6*d.*, and each boy 2*d.* per hour. What is the amount of wages paid in the year?

15. Account for the following rule for calculating interest at 5 per cent.: "Multiply the pounds by the days, and divide the product by 365. The quotient gives the interest in shillings."

16. A. owes £4000 bearing interest at 5 per cent. per annum. He pays at the end of each year for interest and in part payment of the principal £500. Find the amount of his debt at the end of the 3rd year.

17. An estate is divided between 3 persons in the proportion of 4, 6, and 7. Find the value of the estate, and the share of each, when £135 added to the largest share would make it half of the whole.

18. A line of 380 ft. will reach from the top of a precipice, which stands close by the side of a brook, to the opposite bank, and the precipice is 128 ft. high; how broad is the brook?

19. A person has just 2 hours at his disposal. How far may he ride in a coach which travels 12 miles an hour, so as to return home in time, walking back at the rate of 4 miles an hour?

20. A. sets out at 12, and travels 6 miles an hour; B. at 12·30, travelling for half-an-hour at the rate of a mile an hour, and increasing his velocity each half-hour at the rate of a mile an hour. When will B. overtake A., and how far will he have travelled?

21. A society collected annually £30 9*s.* $2\frac{1}{4}$*d.* each member contributing as many farthings as there were members. How many members were there?

22. A garrison of 1000 was provisioned for 30 days; after 10 days it was reinforced, and then the provisions were exhausted in 5 days. Find the number of men in the reinforcement.

23. A person bequeathed to A., B., and C., £2004, to be divided as follows :— A.'s share to be equal to B.'s and C.'s added together ; and C.'s to be equal to $\frac{1}{5}$ of A.'s and B.'s added together. What does each share amount to ?

24. A square-inch plate of metal of ·05 inch thickness is drawn into a wire 50 feet long. Find the area of a section of the wire made by a plane perpendicular to its length.

25. Four men working 8 hours a days take 22 days to pave a road 440 yards long, and 35 feet broad. How many days will 4 men, two of whom work 8 hours and two 10 hours a day, take to pave a road 1575 yards long, and 36 ft. 6 in. broad?

26. If A., B., C., can do a piece of work in 8, 10, and 12 days respectively, find the time in which all working together would do it. Also, supposing that A. and B. work together for 2 days, and that then C. joins them, find the time in which the work will be done.

27. The sum of £6 0*s.* 8*d.* is divided among 16 persons ; find what each receives. And supposing each person to spend 5 shillings, and then to give half of what he has left to 8 poor persons, find how much each of the latter will receive.

28. Multiply together the smallest number consisting of three places of decimals, and the largest consisting of three places of integers ; subtract the product from unity, and express the difference as a vulgar fraction.

29. If in extracting the square root of 0·2 you had by mistake *pointed* thus, 0·20000..., and then proceeded with the operation accordingly ; and after marking off the decimal places in the result, you had discovered your mistake ; what quantity would you have to *multiply* the erroneous result by in order to correct it, without extracting the square root of 0·2 over again ? Find the first three places of decimals in this multiplier.

30. Explain how the area of a surface, and the content of a solid, may be found. From a beam of timber $6\frac{3}{4}$ inches wide, and $5\frac{1}{2}$ inches thick, a piece is cut off containing 1 cubic foot ; find its length.

The surface of a cube is 346·56 square feet ; find the length of an edge.

31. Which party gains by interest being allowed instead of discount ? I want to borrow £1000 for 3 months, the current rate of interest being 4 per cent. What ought I to pay the lender for the use of the money, if I pay him *now ;* and what ought it to be if I pay him at the end of three months ?

32. A spiral staircase contains 100 stairs, of which it takes 10 to go round the circle once; the length of each stair is 3 feet, and its height 9 inches, and the area of the circle is 28 sq. ft. Find how much carpet $1\frac{1}{2}$ yds. wide will cover the stairs.

33. The distance between two stations, A. and B., is 75 miles. A train starts from A. to go to B. at the rate of 20 miles an hour, and is delayed 6 minutes in the way; another train starts from A. an hour after the former, at the rate of 24 miles an hour. Find the interval between their times of arrival at B.

34. If a piece of timber be 225 square inches at the end and 18 ft. long, how many solid feet are contained in it? And if I wish to cut off a solid foot from one end, at what distance from the end must I cut?

35. A messenger starts with an errand at the rate of $3\frac{3}{8}$ miles an hour; another is sent half-an-hour after to overtake him, which he does in 2 hours: at what rate did he ride?

36. Find the side of the square base of a vessel which contains 3025 gallons of water when filled to the depth of 16 ft., having given that a pint of water weighs a pound and a quarter, and a cubic foot weighs 1000 ounces.

37. In extracting the square root of a number which has 7 figures in its root; show that when 4 figures have been found, the remaining 3 may be obtained by dividing by the corresponding *trial* divisor.

38. A trustee invests £10,000 in the following manner:—he puts £5000 in the 3 per cents., which are at 96; and £5000 in a railway speculation where £20 shares are worth $£7\frac{1}{2}$. For this latter he gets no interest during 4 years; but afterwards he gets $5\frac{1}{2}$ per cent. What is the amount in 10 years of the whole sum at simple interest, supposing the shares to be then at par, and the stocks at $96\frac{1}{4}$?

39. A person gave 25*s.* for two tickets (a 1st and 2nd class) from Norwich to Colchester. What did they cost him separately, if a 1st class ticket from Norwich to Diss cost 3*s.* 6*d.*, and a 2nd class 2*s.* 9*d.*?

40. A solid iron ball (7 inches diameter) weighs 64 lbs; another of the same size, with a hollow space in the centre, in the form of a sphere weighs 37 lbs. If the weight varies as the cubes of the radii, find the diameter of the hollow part.

41. The first of six clerks can copy 5 lines as soon as the second copies 6; the second 7 while the third copies 8; the third 11 while the fourth 13; the fourth 19 while the fifth 20; and the fifth 56 while the sixth 57. How many lines can the sixth copy, while the first copies 1,078?

42. An examiner wishes to mark three questions in the proportion of the numbers 2, 3·2, 4·8. The sum of the marks is to be 150, how must he distribute them?

43. A man and a boy engaged to draw a field of turnips for 21*s.*;

but when $\frac{2}{5}$ of the work was done, the boy ran away, and the man then finished it alone. The consequence was that the work occupied $1\frac{1}{2}$ days more than it should have done. Now the boy could only do half a man's work, and is paid in proportion. What did the man receive per day ?

44. Bought a quantity of goods for £150 ready money, and sold them again for £200 payable $\frac{3}{4}$ of a year hence ; what was the gain, supposing discount at 5 per cent ?

45. If a ball whose diameter is 6·3 inches weighs 27 lbs., required the aggregate weight of three balls whose diameters are 8·4, 10·5, and 12·6 inches respectively ? (*Vide*, Ex. 40).

46. A. barters some sugar with B. for flour, which is worth 2*s*. 3*d*. per stone, but uses a false stone-weight of $13\frac{1}{2}$ lbs. What value should B. set upon his flour, that the exchange may be fair ?

47. A person purchases 100 shares in a company at £3,500, and ultimately sells at a profit of 43 per cent. after having received four dividends of 15*s*. 4*d*., 20*s*. 7*d*., 30*s*. 4*d*. and 38*s*. 9*d*. a share. By how much do his receipts exceed his outlay ?

48. In a rectangular court measuring 96 ft. by 84 ft. there are four rectangular grass-plots, measuring each $22\frac{1}{2}$ ft. by 18 ft. ; find the cost of paving the remaining part of the court at 8*d*. per square yard.

49. A person rows 20 miles down a river and back again in 10 hours, the stream flowing uniformly all the way ; and he finds that it takes him as long to row two miles against the stream as three miles with it. Find how long he was rowing down ?

50. A landlord has an estate that brings him in £4,000 a year ; but this gross income is liable to deductions for rating and repairs to the extent of 15 per cent. He sells the estate at 24 years' purchase on the gross income, and invests the price in the 3 per cents. at 95, the broker's commission bring $\frac{1}{8}$th per cent. Find the alteration in his income.

51. If two observers, looking along the same straight line, be placed at opposite points of a circle of 95,000,000 miles radius, and the one sees an external phenomenon 16 minutes before the other, at what rate per second does light travel ?

52. The interest of the National Debt being reckoned at 30 millions per annum, and 3 per cent. the average rate of interest, what reduction in the rate of interest would give the same relief to taxation as the paying off 200 millions of debt, and allowing the interest to be paid on the remainder to continue the same ?

53. A grocer buys 6 chests of tea, containing 84 lbs. each, at 3*s*. 4*d*. per lb., and sells one chest so as to gain 25 per cent. In consequence of a reduction in the duty, he makes an abatement of $5\frac{1}{2}d$. $7\frac{1}{2}d$. $9\frac{1}{4}d$. $11\frac{1}{4}d$.

1*s.* 1¼*d.* per lb. respectively in selling the remaining 5 chests. Find how much he loses by the transaction.

54. The nett rental of an estate, after deducting 7*d.* in the £ for income-tax, and 5 per cent. on the remainder for the expenses of collecting is £959 3*s.* 8*d.* : find the gross rental.

55. A railway platform has two of its opposite sides parallel, and the other two sides equal. The parallel sides are 80 ft. and 92 ft., the equal sides 10 ft. Find the area.

56. The compound interest on a certain sum at 4 per cent. for two years exceeds the simple interest for the same time at the same rate by £16 ; what is the sum ?

57. If the increase in the number of male and female criminals be 1·8 per cent., while the decrease in the number of males alone is 4·6 per cent., and the increase in the number of females is 9·8 ; compare the number of male and female criminals respectively.

58. The specific gravity of cork is ·24, of forged iron 7·6 ; what will be the edge of a cubical mass of iron, which, when placed on a cubic foot of cork, will just immerse it entirely in water ?

59. If a person receives 4½ per cent. interest on his capital by investing in the 3½ per cents, what is the price of the stock, and how much stock can be purchased for £1,200 ?

Supposing a man invest his capital in the 3½ per cents at 94, at what rate per cent. does he receive interest on his capital ; and what income will he have if he invests £1,250 ?

60. If 5 horses require as much as 8 ponies, and 15 quarters last 12 ponies for 64 days, how long may 25 horses be kept for £41 5*s.* when corn is 22*s.* a quarter ?

61. A field in the form of a double square is 75 yards broad ; how long is it, and how many square yards does it contain?

62. If there are 360° in every circle, and in Lat. 30° a degree = 34·75 miles, what is the length of the circle which passes through Lat. 30° ?

63. A tea-dealer buys a chest of tea, containing 3 qrs. 5 lbs. at 3*s.* 2*d.* per lb., and 2 chests, each containing 2 qrs. 15 lbs., at 3*s.* 4½*d.* per lb., what will be the gain per cent. by selling the mixture at 4*s.* per lb. ?

64. The sum of £5 15*s.* 5*d.* is divided between 20 men, 25 women, and 35 children, so that 9 women receive as much as ten men, and 4 children as much as 3 women; find the share of each.

65. A. sells B. 150 cwt. at 3*s.* 10½*d.* per lb. B. gives him £10 17*s.* 6*d.* and the rest in cloth at 11*d.* per yard. How many yards ?

66. The atmosphere presses 15 lbs. on every square inch. If the pressure on a man's body be 30,240 lbs., how many square feet are there in the surface of his body ?

67. How many acres are there in a rectangular field whose sides are 124 yards and 76 yards ; and what is the cost at £230 per acre?

68. A. undertakes to count 300,000 shillings at the rate of 100 per minute, and to pay a farthing for every shilling he does not count. After 36 hours he gives up ; how much has he to pay ?

69. Two men walk 350 miles ; the one walks 19 miles per diem, and the other $16\frac{1}{2}$ ; find what distance they will be from one another at the end of 7 days ; and on what day of the week will the first finish his journey, if they start on Wednesday (Sundays not reckoned)?

70. Exchange 1000 American dollars, worth 4*s.* 6*d.* each, for sterling money, when English money bears a premium of 10 per cent. in America.

71. A cruiser captures a slaver, which is condemned and sold for £28,906 17*s.* 6*d.* In the division of the prize-money, the first-lieutenant receives $\frac{1}{2}$ as much as the captain, a second-lieutenant $\frac{3}{4}$ as much as a first, and a midshipman $\frac{2}{3}$ as much as a second-lieutenant. The sailors get twice as much as the cabin-boys, whose share is $\frac{1}{5}$ that of a midshipman. Suppose the cruiser to have 1 captain, 1 first-lieutenant, 2 second-lieutenants, 5 midshipmen, 250 sailors, and 6 cabin-boys, what will a cabin-boy get ?

72. Exemplify and account for this rule :—"If the price in shillings of a cwt. of goods be multiplied by 3 and divided by 7, the result is the value in farthings of a pound weight."

73. Find the compound interest of £200 for $1\frac{2}{4}$ years at 10 per cent. per annum, supposing the interest payable half-yearly.

74. Given that the area of a circle varies as the square upon its radius, and that the area of a circle whose radius is 7 inches, is 1 ft. 10 in. ; find the area of a circle of which the diameter is 28 inches.

75. A. and B. can mow a field in 4 days ; A. works alone for 2 days, and then they finish it together in $2\frac{1}{2}$ days more. In what time would they have done it separately ?

76. The gross receipts of a railway company in a certain year are apportioned thus :—43 per cent. to pay the working expenses, 52 per cent. to give the shareholders a dividend at the rate of $3\frac{1}{4}$ per cent. on their shares, and the remainder £25,000 is reserved. Find the paid-up capital of the company.

77. What is to be understood by the expression $\frac{£3\ 18s.\ 8d.}{£6\ 12s.\ 9d.}$ ? Take that fraction of 104 yards 9 inches, and reduce the result to the decimal of 17 yards 1 foot 1 inch.

78. Is a fraction increased or diminished by adding the same number to its numerator and denominator ? Give an example.

Out of £4 7*s.* 6*d.*, $\frac{1}{3}$ is paid to A. and $\frac{1}{7}$ to B. After this, $\frac{3}{11}$ of the

remainder is paid to A. and the rest to B. Find the sums respectively received by A. and B.

79. Reduce $\frac{3}{152}$ to a decimal, stating the rule which guides your operations. Find to six places of decimals $\frac{1}{2{\cdot}7182818}$. Take $7\frac{1}{3}$ parts out of 53 from £1 10*s*. Convert $\frac{5}{16}$ into a decimal, by multiplying both numerator and denominator by a common number.

80. Two clocks, one gaining 3 minutes, and the other losing 2 minutes per day, are set right at noon. What is the time by the first clock when the second indicates noon a week afterwards?

81. A merchant increased his capital $\frac{1}{4}$ every year, and at the end of three years one year's interest thereon, at 5 per cent. amounted to £122 1*s*. $4\frac{3}{4}$*d*.; what sum did he begin with?

82. What sum must be insured to cover £2820 in case of loss; the premium being 5 guineas per cent., commission $\frac{1}{2}$ per cent, and policy duty 5*s*. per cent.?

83. If a bill of 90 days be accepted 11th October, when will it be due? Supposing the bill paid on 22nd October, when was it accepted?

84. Fifteen guineas should weigh 4 oz.; but a parcel of light gold, having been weighed and counted, was found to contain 9 more guineas than was supposed from the weight, and it appeared that 21 of these coins weighed the same as twenty true guineas; how many were there altogether?

85. Some smugglers found a cave, which would just exactly hold the cargo of their boat, viz. 13 bales of silk, and 33 casks of rum. While unloading, a revenue cutter came in sight, and they were obliged to sail away, having landed only 9 casks and 5 bales, and filled one third of the cave. How many bales separately, or how many casks, would it hold?

86. A street is 500 feet long; there are 25 houses on one side, and the houses on the other side are each 25 feet wide. How many party-walls on one side are exactly opposite party-walls on the other? and which are they?

87. Shew that the division of a fraction by any number is effected either by dividing the numerator, or by multiplying the denominator by that number. Find the value in pounds of $\frac{\cdot213348}{\cdot326}$ of 2 cwt. 102 lbs. Add $\frac{3}{5}$ of 4*s*. 7*d*. to $\frac{7}{20}$ of 1*s*. $5\frac{1}{2}$*d*., and subtract $\frac{31}{48}$ of a crown from the result. Compare the values of $5 \times \cdot05$, $1\cdot5 \times \cdot75$ and $2\cdot625 \div 5$.

88. When will a mean proportional between two numbers be *integral*? In a false pair of scales, some goods weighed in one scale were 64 lbs. and in the other 49 lbs.; required the real weight of the goods.

89. From unity subtract $\frac{1}{2}$, add $\frac{1}{3}$, subtract $\frac{1}{4}$ and add $\frac{1}{5}$; then find the ratio of the result to the fraction of $\frac{4}{5}$ of $1\frac{2}{3}$. Required the continued pro-

duct of $\frac{1}{5}$ of $5\frac{1}{2}$, $\frac{2}{9}$ of 11 and $\frac{13}{204}$. Find the value of 1·875 of a guinea + 1·875 of a crown + 1·875 of £3·625. Multiply $3-1\frac{6}{7}$ by $\frac{1}{2}$ of $(2-\frac{1}{4})$.

90. By selling tea at 5*s.* 4*d.* a pound, a grocer clears $\frac{1}{8}$th of his outlay. He then raises the price to 6*s.*; what does he clear per cent. at the latter price? and what would he gain per cent. if he cleared $\frac{1}{8}$th of the *selling price*?

91. A cistern whose length is 3 ft., breadth 2 ft., and depth 11 ft., is supplied by a larger one, whose length, breadth and depth are 22 ft., 12 ft. and 40 ft. respectively. What depth of water must be let off from the large cistern, so as just to fill the small one? What would be the radius of a circular cistern, which, let off to the same depth, would fill the other?

92. If, when wine is 80 guineas a pipe, 60 persons drinking for a certain time spend £20, what is the worth of a pipe, when 15 persons more spend £65 in double the time?

93. A certain number of men mow 4 acres in 3 hours, and a certain number of others mow 8 acres in 5 hours; how long would they be in mowing 11 acres, all working together?

# ANSWERS

TO THE

# EXAMPLES IN ARITHMETIC.

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## Ex. 1.

1. £39 6*s.* 7½*d.* 2. 77745. 3. 525948.
4. 132 yds. 2 ft. 7 in. 5. $13\frac{27}{32}$; $\frac{25}{32}$. 6. $\frac{11}{20}$ and ·035.
7. ·00625, 13000, and 13. 8. 7*s.* 6·144*d.* and ·00125.

## Ex. 2.

1. 83 acres 28 poles. 2. 592. 3. 328.
4. ·0012302728 and 6000. 6. ·3135416 and 8·1648*d.*
7. 5. 8. £127 10*s.*

## Ex. 3.

1. 113 and 3344. 2. 2304 ins. 3. 102 lb. 2 oz. 13 dwt. 19 gr.
4. £6. 11*s.* and ·655. 5. ·00002, 628000, 7·95. 6. 976.
7. 16 and $26\frac{26}{189}$. 8. 2 fr. 13 cent.

## Ex. 4.

1. 9464; £2 16*s.* 3*d.* 2. 1062 and 3*s.*, and £102 12*s.* 3. 202 m.
4. 3*s.* 6*d.* or £·175. 5. 23. 6. 253000 and $\frac{3}{5}$.
7. £260 5*s.* and £234 4*s.* 6*d.* 8. $\frac{1}{15}$.

## Ex. 5.

1. 26; 3. 2. 168. and $\frac{37}{504}$, $\frac{189}{504}$, $\frac{224}{504}$, $\frac{105}{504}$, $\frac{49}{504}$.
3. 107 tons 2 cwt. 3 qr. 12 lb. 4. $\frac{5}{78}$. 5. 2258·62.
6. $\frac{1}{4}$. 7. ·733. 8. 36 Pauls.

## Ex. 6.

1. £4 0*s.* $8\frac{7}{20}$*d.*, $4\frac{167}{4800}$, $1\frac{59}{77}$. 2. 9·079224 and ·00031416.
3. 35712. 4. £142 0*s.* $11\frac{3}{4}$*d.* 5. £4 3*s.* 4*d.*
6. ·45 and 1. 7. $\frac{10}{11}$, $\frac{5}{39}$, $\frac{8}{13}$. 8. 70 ft. 8·232 in.

### Ex. 7.

1. 57452. 2. 22004·940022; ·067. 3. 94080000 miles; ·99726; $3\frac{177}{1225}$.
4. £25 11*s.* 4*d.* 5. $\frac{52}{219}$, $\frac{468}{2245}$, and $\frac{77}{33}$. 6. £5 0*s.* 7½*d.*
7. £1 6*s.* 8*d.* 8. $1\frac{217}{1111}$ yd.

### Ex. 8.

1. 10, ·0055060951 and ·09082009. 2. $6\frac{2}{15}$, $\frac{83}{256}$, $5\frac{117}{140}$.
3. 3·142857 and $\frac{1}{7}$. 4. £31 10*s.* 5. £175. 6. $\frac{542}{675}$.
7. 365 d. 5 hr. 49 min. 12 sec. 8. £19 17*s.* $9\frac{3}{11}d.$

### Ex. 9.

1. 200, 1000, 1500, 8 cwt. 8 qr. 2. ·821875. 3. 9*s.* 6*d.*
4. $7\frac{7}{20}$; $\frac{48}{80}$. 5. $40\frac{10}{45}$. 6. $\frac{5}{12}$ and ·645497.
7. £13 1*s.* $6\frac{4}{5}d.$ 8. £17 14*s.* 6*d.*

### Ex. 10.

1. 9 hrs.; ·57285, 1111·1. 2. $\frac{5}{7}$; $\sqrt{2}$; and $\frac{10}{21}$. 3. ·54321.
4. 2880. 5. £84 11*s.* $9\frac{6}{7}d.$ 6. £23 16*s.* $2\frac{3}{7}d.$
7. £253. 8. 24 c. ft. 8 c. in.

### Ex. 11.

1. $4\frac{15}{16}$, $\frac{5}{16}$. 2. 4·05 and 37. 3. ·4725, and 6 h. 7 m. 12 s., £1 14*s.* 3*d.*
4. 400 and $95\frac{5}{21}$. 5. 6 lb. 5 oz. 8 dwts. 6. £821 5*s.*
7. 10*d.* 8. £33 18*s.* 4*d.*

### Ex. 12.

1. 509688, ·0231 of a guinea. 2. $\frac{15}{16}$ and 3·083. 3. 15*s.* $6\frac{3}{5}d.$, and $\frac{633}{1180}$.
4. £580. 5. 96 sq. ft. 93 sq. in., and £4 4*s.* $1\frac{17}{20}d.$
6. £107 8*s.* $5\frac{1}{4}d.$ 7. $4\frac{3}{4}d.$ 8. £214.

### Ex. 13.

1. 10200000, £4166 13*s.* 4*d.* 2. 2*s.* 7*d.*, ·3741609375, 15·7406.
3. 532125. 4. £409 10*s.* $2\frac{1}{4}d.$ 5. £257 14*s.* $7\frac{23}{50}d.$
6. £300. 7. 377 sq. ft. $125\frac{5}{8}$ sq. in. 8. 9 months.

### Ex. 14.

1. $\frac{288}{1681}$, £192; 111. 2. $5\frac{1}{3}$, $\frac{9}{217}$, $\frac{171}{353}$, $\frac{2}{7}$. 3. £48 3*s.* $1\frac{1}{2}d.$
4. £172. 5. £765. 6. 20 gallons.
7. $1\frac{13}{47}$ days. 8. The $3\frac{1}{2}$ per cents.

## Ex. 15.

1. ·0000004 and ·05. 2. 1*s.* 3*d.* 3. 907, 1·67, and 2·23606....
4. 11 po. 4 yd. $2\frac{1}{18}$ feet. 5. 3 fr. 84 cent. 6. 61023·377953.
7. $155\frac{3}{4}$. 8. £621 2*s.* $2\frac{3}{4}d.$

## Ex. 16.

1. $\frac{4}{37}$ and $\frac{1}{9}$. 2. $195\frac{65}{91}$. 3. £15 5*s.* 6*d.* and $\frac{1}{330}$.
4. £2 14*s.* 10*d.* 5. £2. 6. £141 5*s.*
7. $5\frac{3}{5}d.$, £22 8*s.* 8. £150, £300, £450.

## Ex. 17.

1. 1707920929, ·0034, 200 and ·00016. 19*s.* $5\frac{1}{2}d.$ and 1*s.* $3\frac{3}{4}d.$
3. $\frac{1720}{10647}$ and $\frac{83}{131}$. 4. 12 lb. 1 oz. $12\frac{324}{215}$ dr. 5. £62 5*s.* 5*d.*
6. £4050 and £3 6*s.* 8*d.* per cent. 7. $\frac{8}{7}$ hr. 8. 2005 in.

## Ex. 18.

1. £1 7*s.* $4\frac{56}{79}d.$ 2. 1*s.* $3\frac{3}{4}d.$ and ·375, 5 h. 31m. 12 s.
3. ·661; ·017; and 11·2. 4. 3 oz. $7\frac{1}{16}$ dwt. 5. $1\frac{38}{61}$ and 72.
6. £9 1*s.* $3\frac{1}{33}d.$ 7. 12*s.* 8*d.*, £80. 8. £2 6*s.* 8*d.*

## Ex. 19.

1. £367 10*s.*, $2\frac{18}{35}$; $\frac{1}{21}$; and $1\frac{43}{120}$. 2. £15 0*s.* $7\frac{1}{2}d.$ 3. £3970 0*s.* $4\frac{1}{2}d.$
4. 60 days. 5. £4070 2*s.* $3\frac{3}{4}d.$ 6. £100.
7. £116 13*s.* 4*d.* 8. £833 6*s.* 8*d.*

## Ex. 20.

1. 20542·5, 1 A. 5·99 P. and 53. 2. $233\frac{1}{3}$ and $122\frac{1}{2}$. 3. £450.
4. £352 13*s.* $7\frac{1063}{1460}d.$ 5. 8*d.* 6. 9 fl. 20 kr.
7. 8. 8. £$13\frac{7}{11}$ minutes.

## Ex. 21.

1. 1023, $\frac{1}{132}$ and $\frac{5}{2304}$. 2. £9 3*s.* $5\frac{1}{2}d.$ and £17 0*s.* $8\frac{1}{2}d.$
3. 3 cwt. 1 qr. 5. 17 cwt. 2 qr. 20 lbs. and £27 10*s.*
6. £236 8*s.* 6*d.* 7. £7900, and £6310 2*s.* 6*d.* 8. £573 10*s.* and 6.

## Ex. 22.

1. $\frac{14}{75}$, $\frac{5}{128}$, and 3 hr. 36 m. 2. 89·395 and ·1044. 3. 116.
4. £613 2*s.* 8*d.* and £6 2*s.* 7·52*d.* 5. £3 14*s.* $3\frac{81}{109}d.$ 6. 12.
7. 4*s.* 2*d.* 8. 10 min. past 5.

## Ex. 23.

1. £310 3*s.* $7\frac{11}{35}$*d.*; 1697760. 2. 3*s.* $5\frac{13}{45}$*d.* 3. £1 2*s.* $9\frac{3}{4}$*d.*
4. $36\frac{3141}{4330}$ days. 5. $1\frac{3}{13}$ and 125. 6. $12342\frac{6}{7}$.
7. £7 and £31 18*s.* $4\frac{1}{3}$*d.* 8. $1\frac{5}{7}$ hours.

## Ex. 24.

1. 8·23, ·5, ·01, ·005, ·9688194. 2. £50 0*s.* $9\frac{17}{40}$*d.* 3. $19\frac{11}{12}$ and $15\frac{455}{1008}$.
4. 560·224.... 5. £111 8*s.* $1\frac{151}{371}$*d.* 6. 17 c. ft. 415 c. in.
7. The gain is £1 9*s.* 4*d.* per cwt. 8. £266 13*s.* 4*d.*; £333 6*s.* 8*d.*; £400.

## Ex. 25.

1. 2999790, 3*s.* $4\frac{1}{3}$*d.*, $\frac{17}{100}$, ·17. 2. £59 14*s.* 8*d.* 3. $\frac{1}{88}$.
4. 935 sq. ft. $38\frac{1}{4}$ sq. in.; £15 11*s.* $9\frac{1}{10}$*d.* 5. £40 4*s.* 2*d.* or $\frac{1}{4}$th.
6. £3 2*s* 6*d.*; 10*d.* 7. $311\frac{19}{346}$ days. 8. ·12649.... and 50.

## Ex. 26.

1. 234, 7·01026903. 2. £26 5*s.* 3. $\frac{8}{9}$ and 335·3.
4. 400 acres and £22,000. 5. $2\frac{22}{31}$ hr. 6. 12 in.
7. £420 and £477 5*s.* $5\frac{5}{11}$*d.* 8. £29 18*s.* $6\frac{66}{197}$*d.*, £26 2*s.* 6*d.*

## Ex. 27.

1. ·1375, and 1 qr. 11 lb. 3 oz. 3·2 dr. 2. 5·0435, $\frac{11}{25}$. 3. 38763.
4. 640. 5. 7*s.* $7\frac{1}{4}$*d.* per cent. 6. £4 14*s.* 6*d.*
7. 2*s.* 6*d.* and $4\frac{1}{2}$*d.* 8. $27\frac{3}{11}$ mm. past 2.

## Ex. 28.

1. 847, 4*s.* $9\frac{1}{2}$*d.*, and ·25. 2. 2 and 213·415596. 3. £60786 13*s.* $3\frac{1}{2}$*d.*
4. £1191 10*s.* $1\frac{1}{2}$*d.* 5. 19*s.* $7\frac{1}{2}$*d.* 6. $16\frac{2}{3}$, and $23\frac{1}{3}$ in.
7. £7 9*s.* $11\frac{1}{10}$*d.* 8. $9172\frac{124}{133}$ m.

## Ex. 29.

1. 2*s.* $5\frac{3}{5}$*d.* and ·375. 2. £544 14*s.* 11*d.* 3. ·753 and ·0632.
4. £1239 3*s.* $1\frac{207}{559}$*d.* 5. £$143\frac{5}{7}$ 15*s.* and £53 9*s.* $8\frac{4}{61}$*d.* 6. £11 6*s.* 5*d.*
7. 20. 8. £3 5*s.* $11\frac{19}{91}$*d.*

## Ex. 30.

1. A. 23., B. 90. 2. ·0125, ·0005416 and $9\frac{8}{13}$; 17*s.* $4\frac{8}{9}$*d.* 3. 3 and 3*s.* $1\frac{11}{11}$*d.*
4. £3 7*s.* $7\frac{101}{180}$*d.* 5. He gains £5 10*s.* $3\frac{87}{131}$*d.* per annum.
6. $1\frac{1}{8}$ days. 7. $19\frac{1331}{1333}$ in.
8. 25 to each of the eight; to the rest 16, 20, 28, 36.

## Ex. 31.

1. 3, £3 14s. $3\frac{1}{4}d.$ 2. £116 1s. 3. 286 d. 17 hr. $18\frac{3}{5}$ in.; $\frac{8}{13}$ and $\frac{163}{16300}$.
4. £11 11s. 5. £714 8s. $7\frac{31}{50}d.$ 6. $1\frac{2}{103}$.
7. 4s. 4d. 8. 30 m.

## Ex. 32.

1. $\frac{21}{800}$, and 3 qr. 21 lbs. 2. 10 and 3. 3. ·176 and ·98.
4. £16 10s. $8\frac{8}{9}d.$ 5. ·845, ·0207, 1·70.... 6. 8 ft. 4 in.
7. 50 per cent. 8. 8s.

## Ex. 33.

1. 634365, 2d. 2. 5·31441. 3. 19s. $5\frac{1}{2}d.$
4. £127 5s. $6\frac{45}{56}d.$ 5. 1141 c. ft. 1512 c. in. and £41 12s. $7\frac{13}{32}d.$
6. 3 : 13. 7. £34 9s. $7\frac{25}{29}d.$ 8. 40 m. $36\frac{7}{48}$ s. past 10.

## Ex. 34.

1. 72, 2 qr. 17 lb. 1 oz. $3\frac{1}{13}$ drs. 2. $\frac{1}{1120}$ and $\frac{2}{31}$. 3. ·3305 and $\frac{18}{999}$.
4. £378 and £11,970. 5. 161·29 in. 6. 5.
7. A.'s £78, and B.'s 104. 8. B. 6d., and C. 2s. 6d.

## Ex. 35.

1. 351 and 96. 2. ·2317 and ·3, 3·1416, ·538461. 3. £12 12s. $6\frac{1}{4}d.$
4. £16 4s. $7\frac{473}{625}d.$ 5. £704 15s. $1\frac{9}{10}d.$ 6. 26 years.
7. ·104 days. 8. 360 m. and the times are 10 and 12 hr.

## Ex. 36.

1. 35707428, $\frac{1}{11}$. 2. 16s. $9\frac{1}{2}d.$ and $\frac{133}{400}$. 3. 71·498 and 125000.
4. £53 2s. $0\frac{7}{8}d.$ 5. £175 and 170 9s. $1\frac{1}{11}d.$ 6. 7 yr.
7. £28 4s. 8. £1 0s. $9\frac{25}{36}d.$

## Ex. 37.

1. ·00184, $\frac{2}{3}$ and $\frac{181}{495}$. 2. $1\frac{14}{33}$ and 3d. 3. 1d.
4. £212 10s. and £3045 16s. 8d. 5. £18 10s, $3\frac{17}{350}d.$
6. £183 12s. 4d. 7. £65 12s. 8. $81\frac{3}{8}$ days.

## Ex. 38.

1. 1·00951444, ·16 and 20,000. 2. £4 1s. 8d. and £2 18s. 4d.
3. ·4256 nearly, and ·42. 4. 4. 5. £159 12s.
6. 458·7 and 215·435. 7. 1 : 2. 8. 12, 18, 24.

### Ex. 39.

1. 7, £9067 12*s.* 5*d.* 2. 1·575 and 3*s.* 4½*d*, $\frac{5}{11}$. 3. 4*s.* 3¾*d.*
4. £143 5*s.* 10$\frac{10}{11}$*d.* 5. £16 0*s.* 11*d.* 6. 27·2 in.
7. £69 10*s.* 8*d.* 8. £2000.

### Ex. 40.

1. 1·7$\dot{5}$, 54407·99 and 6·714. 2. 274 sq. ft. 58$\frac{1}{16}$ sq. in. 3. £1 2*s.*
4. 19·49, ·2, 97·8, and 13. 5. £1047 1*s.* 8*d.* 6. 288$\frac{52}{207}$.
7. 10 ft. 8. He will gain £10.

### Ex. 41.

1. 1557, £1 3*s.* 6$\frac{1}{4}$*d.* 2. £11 15*s.* 3. £4 5*s.*
4. £19 10*s.* 11$\frac{7}{10}$*d.* 5. 60. 6. £200, £333 6*s.* 8*d.*, £466 13*s.* 4*d.*
7. 15*s.* 10$\frac{52}{75}$*d.* 8. 25$\frac{5}{7}$ min.

### Ex. 42.

1. £161 5*s.*; 7; 5. 2. $\frac{22}{133}$. 3. 7910 ft.
4. 7,783,600 c. ft. 5. A.'s £35 14*s.* 3$\frac{3}{11}$*d.*; B.'s £36 7*s.* 3$\frac{3}{11}$*d.*
6. 30. 7. 524. 8. £66 3*s.* 11$\frac{2310}{1331}$*d.*

### Ex. 43.

1. 33792000. 2. 11*s.* 11$\frac{1}{3}$*d.* 3. £4 1*s.* and $\frac{6}{37}$, $\frac{111}{185}$.
4. 1$\frac{11}{13}$ days. 5. £19,200. 6. £952 1*s.* 9·12*d.*
7. 10*s.* 8. 270 yd.

### Ex. 44.

1. 27. 2. ·6 and ·5$\dot{7}$1428$\dot{5}$. 3. $\frac{141}{215}$, $\frac{11}{38}$.
4. £36, £12, £16. 5. 89$\frac{63}{80}$. 6. 15 c. yd. 2 ft. 1673 in; 20 in.
7. 7. 8. £24.

### Ex. 45.

1. 9828 and 79. 2. £19 4*s.* 9*d.* 3. 3·3834054; $\frac{113}{333}$.
4. £16 12*s.* 1½*d.* 5. 1646·704. 6. A. 27½, B. 24½, C. 33½.
7. £1913 6*s.* 8*d.* 8. 136 yd. 2 ft. 8 in.

### Ex. 46.

1. $\frac{32}{707}$ and $\frac{1}{77}$. 2. £4 16*s.* 3. ·1$\dot{3}$, ·01236 and 3 qr. 21 lb.
4. £8 8*s.* 7¼*d.* ny. 5. £1 1·9471*s.* 6. 1 ft. 9½ in.
7. The 3½ per cents. by $\frac{35}{36}$ per cent. 8. £9 2*s.* 8$\frac{1008}{1331}$*d.*

### Ex. 47.

1. 123463578, ·0708, and ·31739583.
2. $\frac{1}{3}$ and $2548\frac{11}{60}$.
3. $\frac{1}{2}$ and ·89802.
4. $622\frac{3}{8}$ acres.
5. £639 13*s.* $5\frac{77}{169}$*d.* and £11 19*s.* $10\frac{85}{169}$*d.*
6. £9 2*s.* $4\frac{13}{40}$*d.*
7. 7 sq. yd. 120 sq. in. and £2 2*s.* $6\frac{3}{5}$*d.*
8. A. $7\frac{21}{25}$, B. $6\frac{11}{25}$ miles.

### Ex. 48.

1. A. 12, B. 36, and C. 90.
2. £223 11*s.* 3*d.* and £2 8*s.*
3. 5*s.* 7*d.*
4. $\frac{1865}{5832}$.
5. £1283 6*s.* 8*d.*
6. 48 sq. ft. 108 sq. in.
7. £1658 5*s.*
8. 70 days.

### Ex. 49.

1. £227 12*s.* 1*d.*
2. $\frac{1}{3}$ and $\frac{1}{7}$.
3. 2*s.* $5\frac{13}{23}$*d.*, and 2*s.* $5\frac{3}{5}$*d.*, 66·666.
4. £2 11*s.* $1\frac{1}{7}$*d.*
5. $13\frac{1}{7}$ ft.
6. $10\frac{10}{19}$.
7. 320 days.
8. £960.

### Ex. 50.

1. 17·8253119..., $\frac{3}{7}$, $3\frac{5}{111}$, $\frac{7}{22}$.
2. $13\frac{1}{3}$ and 65934, 10 A. 2 R. 16 P.
3. ·1027.
4. $\frac{87}{2500}$ nearly.
5. $37\frac{1}{3}$ and 1·21.
6. 16.
7. $\frac{11473}{14161}$ sq. ft.
8. 36.

### Ex. 51.

1. 14808, 330156.
2. 5·69$\frac{1}{4}$ and $5\frac{1}{3}$*d.*
3. 88 yd.
4. £95 4*s.* $9\frac{1}{4}$*d.* and £95.
5. £1200.
6. 105 days.
7. £8250.
8. 2 hr. $46\frac{2208}{5117}$ m.

### Ex. 52.

1. £285 3*s.* $1\frac{1}{2}$*d.* and £8 6*s.* $4\frac{3}{19}$*d.*
2. £898 9*s.* 3*d.*; £598 19*s.* 6*d.*; £299 9*s.* 9*d.*
3. $1\frac{19}{35}$, $\frac{1}{3}$, $\frac{2625}{6}$.
4. $120\frac{8}{9}$.
5. 149 yd. $1\frac{1}{2}$ ft. nearly.
6. £11 5*s.*
7. 23 cwt. 60 lbs. $11\frac{1}{2}$ oz.
8. 10.

### Ex. 53.

1. 667650, 24.
2. 2*s.* $11\frac{1}{4}$*d.*
3. £292 1*s.* 6*d.* nearly.
4. £996 0*s.* $8\frac{46}{353}$*d.*
5. £16 18*s.*
6. 80 days.
7. $\frac{1}{3}$ and $\frac{3}{7}$.
8. £35 and £49.

### Ex. 54.

1. £900, £750, £150.
2. 1.
3. 148·8906; ·8$\frac{1}{4}$.
5. £4 3*s.* 4*d.* per cent.
6. 9180 lbs.
7. $1\frac{2}{15}$.
8. 577$\frac{7}{9}$ lbs., and £21 13*s.* 4*d.*

## Ex. 55.

1. £40, £10, £5. 2. 55. 3. 2·7182818, ·8.
4. £26 6*s*. 5. 24 in. 6. 2*s*. $1\frac{1}{2}$*d*.
7. A.'s £57,142$\frac{6}{7}$, B.'s £42,857$\frac{1}{7}$. 8. $\frac{3}{880}$.

## Ex. 56.

1. 1000. 2. $\frac{107}{840}$. 3. 6*s*. 6*d*., $\frac{1}{21}$.
4. £5 12*s*. $1\frac{1}{11}$*d*. 5. $18\frac{3}{4}$. 6. £1250; and £2 10*s*. less.
7. $79\frac{1}{17}$ ft. 8. 4 times.

## Ex. 57.

1. 1 and $\frac{1}{8}$. 2. $4\frac{15}{17}$*d*. and $3\frac{5}{17}$*d*. 3. £2 2*s*. $3\frac{1}{2}$*d*.
4. ·026, 2·6404. 5. £402 10*s*. 6. £5 0*s*. $3\frac{1}{8}$*d*.
7. A.'s £290 6*s*. $5\frac{13}{31}$*d*.; B.'s £309 13*s*. $6\frac{18}{31}$*d*. 8. 39·24 yd.

## Ex. 58.

1. 2520, $1\frac{3}{8}$. 2. 14 cwt. 3 qr. $4\frac{3}{4}$ lb. 3. $1\frac{7}{24}$; $20\frac{1}{2}$.
4. $\frac{5}{18}$ and 4698. 5. £16 19*s*. $5\frac{388}{707}$*d*. 6. 3 hr.
7. £117 14*s*. $4\frac{1}{6}$*d*. nearly. 8. £320.

## Ex. 59.

1. $\frac{1}{4}$, $3\frac{9}{123}$, $4\frac{5}{14}$; and ·625, ·714285, 1. 2. £2 0*s*. $9\frac{63}{100}$*d*. and £2 0*s*. $1\frac{273}{611}$*d*.
3. 8*s*. 2*d*.; $\frac{1}{156}$, ·15. 4. £1000. 5. 50 days, and $21\frac{3}{7}$ days.
6. $3\frac{3373}{6144}$. 7. 104 days. 8. $\frac{3}{4}$ AC.

## Ex. 60.

1. ·00001483776, ·10304, $\frac{131}{175}$, $\frac{1}{3}$, $237\frac{15}{38}$. 2. £221 17*s*. 6*d*. 3. 600.
4. £769 5*s*. 5. 13 ft. 1 in. 6. $9\frac{79}{81}$.
7. £97 4*s*. $5\frac{1}{3}$*d*. 8. $69\frac{3}{4}$ miles from Lincoln.

## Ex. 61.

1. 98, 312. 2. 1 and ·7. 3. 15 cwt. 4. $1579\frac{31}{32}$ in.
5. $11\frac{1}{4}$. 6. $17\frac{1}{7}$ min. 7. 30 and 5. 8. $871\frac{319}{1340}$.

## Ex. 62.

1. 216, 1080, 12960. 2. $\frac{1345}{9}$, $345\frac{1}{3}$, $61\frac{7}{33}$. 3. £24 17*s*. 3*d*.
4. £21 5*s*. 5. £411 0*s*. $9\frac{31}{40}$*d*. 6. £82 19*s*. $1\frac{1}{11}$*d*., £176 19*s*. $4\frac{4}{11}$*d*.
£193 11*s*. $2\frac{6}{11}$*d*., £276 10*s*. $3\frac{7}{11}$*d*. 7. 16. 8. $2\frac{1}{2}$ hr.

### Ex. 63.

1. 2·3984375, $2\frac{1}{8}$. 2. $\frac{7049}{816}$, $\frac{7065}{816}$, $\frac{7097}{816}$. 3. £33.
4. 6300. 5. £1 17*s.* 10*d.* 6. 73 yd. 1 ft.
7. 2, 2, 5. 8. 11 A. 4 P.

### Ex. 64.

1. 1 A. 28 P. 2. ·66 and ·0005882352941176470.
3. 2741, 8765, and 21. 4. ·0683468, 200, and ·000005.
5. £38 3*s.* 6. 4*s.* 4*d.* 7. £16 13*s.* 4*d.* 8. £1 5*s.* and £1.

### Ex. 65.

1. £34 8*s.* $2\frac{1}{4}d.$ 2. £5 8*s.* 3. $1\frac{1}{8}$ and 6*d.*, $1\frac{11}{13}$. 4. £61 12*s.*
5. £2 13*s.* 4*d.* 6. 7891 m. 728 yd. 2 ft. 8 in. 7. 688 13*s.* $2\frac{1}{4}d.$
8. 75 leagues.

### Ex. 66.

1. 1002020. 2. 1221. 3. $\frac{418417}{1753200}$.
4. 3·6, 1·145, ·135... 5. 300. 6. $58\frac{4}{5}$.
7. £3 0*s.* $9\frac{405}{809}d.$ 8. 42 in.

### Ex. 67.

1. 12·50376; 2 m. 2 f. 168 yd. 2 ft. 10·56 in. 2. $18\frac{2}{3}$, 9 oz. 3 dwt. 8 gr., $\frac{3}{8}$.
3. 3. 4. 75, £19 12*s.* 4*d.*
5. $21\frac{3}{5}$. 6. £16 13*s.* 4*d.*
7. 6 hr. $5\frac{5}{11}$ min. 8. $7\frac{23}{66}$ ft.

### Ex. 68.

1. £14 16*s.* $3\frac{3}{8}d.$ 2. £9 4*s.* 3*d.* and $\frac{23}{3600}$. 3. 2083 c. ft. 576 c. in.
4. 85264 and 525, 125. 5. $5\frac{86}{105}$ and $\frac{120}{323}$. 6. £6 16*s.* $4\frac{19}{50}d.$
7. 3 hr. $49\frac{1}{11}$ min. 8. 35.

### Ex. 69.

1. 10950. 2. 198·72, 1 f. 2 c. 5 m. 3. $1\frac{5}{7}$ hr. 4. £9 9*s.* 7*d.*
5. £210. £240, £290. 6. $9\frac{3}{5}$ days. 7. 10*s.* 6*d.* 8. 648.

### Ex. 70.

1. 2*s.* 9*d.*, ·088278. 2. 5, 3, 12. 3. 10*s.* $1\frac{1}{2}d.$ and $\frac{81}{160}$. 4. 3.
5. 76 sq. in. 6. Loss, $4\frac{1}{2}d.$ 7. £4000. 8. 12, 14, 16, 18.

## Ex. 71.

1. 1249776 and 125 yd. 2 ft. 4 in. 2. 8*s.* 4*d.* and $\frac{1}{12}$. 3. 50653.
4. 15*s.* and £386 14*s.* 4½*d.*, £305 5*s.*, £220. 5. £104 8*s.* 4*d.*
6. £2531 5*s.* 7. 24. 8. 30 m. and 70 m.

## Ex. 72.

1. 13⅓ and ·21$\dot{6}$, ·2$\dot{5}$, ·1$\dot{6}$. 3. £130 10*s.* 0$\frac{4}{9}$*d.*, £2560. 4. 37½.
5. £2200. 6. 4. 7. $\frac{2}{3}$. 8. 5 miles.

## Ex. 73.

1. 3396. 2. ·41$\dot{6}$ and 4·992, 13·$\dot{3}$. 3. 1$\frac{1}{12}$ and 12.
4. £1 11*s.* 0$\frac{328}{365}$*d.* 5. £66 13*s.* 4*d.* 6. £1 14*s.* 7$\frac{85}{137}$*d.*
7. 11. 8. 226800.

## Ex. 74.

1. £228 13*s.*, 3 and 128·41. 2. ·6875. 3. 500 guineas.
4. 64$\frac{1}{4}$. 5. The 3½. 6. 11*s.* 9$\frac{3}{8}$*d.*, £368 15*s.* 0$\frac{3}{4}$*d.*
7. 32 : 15. 8. 4484925.

## Ex. 75.

1. ½, 2, and £49 9*s.* 5½*d.* 2. 279. 3. £363 3*s.* 6¼*d.*
4. He lost 6*d.* 5. 96 days. 6. 24$\frac{3}{8}$ lbs. 7. £8 5*s.* 4½*d.*
8. The Julian is 7·736 days too much ; the Gregorian, ·264 days too little.

## Ex. 76.

1. 45728$\frac{55}{405}$, 26. 2. 68,000 miles. 3. 20, 18, 15, 12, 10.
4. $\frac{118}{210}$. 5. £1 17*s.* 7½*d.* 6. £125.
7. 5 ft. 9 in. nearly. 8. £24 3*s.* 5*d.*

## Ex. 77.

1. 1260$\frac{23}{45}$, $\frac{8}{9}$, ·2$\dot{1}$5306$\dot{}$ and ·261115$\dot{6}$. 2. 2 P.M., 81 degrees West.
3. 59$\frac{6}{17}$ and 108$\frac{13}{17}$. 4. 64. 5. 9. 6. 1148 miles nearly.
7. 4872 days. 8. 4½ hr.

## Ex. 78.

1. 2 and 5; ½, ⅓, ¼, ⅕. 2. 1$\frac{33}{43}$. 3. £20. 4. 6$\frac{3}{10}$.
5. 3*s.* 1$\frac{17}{20}$*d.* 6. 131·578... 7. 50; 21$\frac{3}{7}$ days.
8. The first gives the second £266 13*s.* 4*d.*, and the third £1866 13*s.* 4*d.*

## Ex. 79.

1. 30 miles. 2. £2 17*s.* $1\frac{4}{21}$*d.* and $1\frac{3}{14}$. 3. £47 16*s.* 3*d.*
5. £840, £980. 6. 35 ft. 7. 25·95 ft. 8. 2 hr., $1\frac{1}{4}$ hr.

## Ex. 80.

1. $1042\frac{1}{2}$ miles. 2. 70 and 1325. 3. £41 14*s.* 6*d.*
4. £5 12*s.* 6*d.* 5. £320. 6. 280 sq. ft. and 18 guineas.
7. $7\frac{1}{2}$ hr.; 90 and 75 miles. 8. 9.

## Ex. 81.

1. £640 9*s.* $2\frac{4}{25}$*d.*, £1144 0*s.* $11\frac{29}{80}$*d*, $83\frac{16}{45}$. 2. ·900449...and 5 cwt. 2 qr. 21 lb.
3. 7 sq. ft. 16 sq. in., and 18 c. ft. 1664 c. in. 4. £12 13*s.* $2\frac{4}{7}$*d.*
5. 4000. 6. £800. 7. £1 5*s.* 8. £60 and $7\frac{9}{13}$.

## Ex. 82.

1. £1 4*s.* 2. 28. 3. 6031, $7\frac{2}{3}$ and $\frac{2}{3}$.
4. 171 ft. nearly. 5. A. £45, B. £90, C. £225. 6. 4.
7. £51 15*s.* $10\frac{8}{9}$*d.* and $11\frac{13}{17}$ years. 8. 40.

## Ex. 83.

1. 28032, $\frac{22848}{69725}$, $\frac{10417}{195650}$. 2. 5·94182, ·34818, 8·7959989, 196000, and 1.
3. $15\frac{5}{8}$ c. ft. 4. 9*d.* 5. 12 days, $12\frac{26}{57}$.
6. 45. 7. $5\frac{173}{180}$ grs. 8. 16 fr. $96\frac{8}{9}$ cent.

## Ex. 84.

1. 1771, £3 12*s.* 3*d.* 2. ·025, 7 ft. 5 in. 3. £2 5*s.* 7*d.*; £4 11*s.* 2*d.*
4. 190, 170, 140. 5. 10 days, $3\frac{1}{3}$ days. 6. 2*d.*
7. £325; £275. 8. 2·761 miles; 6·526.

## Ex. 85.

1. ·54, 13 poles 2 yd. 1 ft. 4 in.; ·22. 2. £1 1*s.* $5\frac{42}{43}$*d.*; £1 1*s.* $3\frac{8235}{9863}$*d.*
3. £4591$\frac{73}{697}$; £4481$\frac{238}{359}$; $3\frac{1}{4}$. 4. £12; £8; £6. 5. £4 16*s.*
6. 10. 7. ·24 ft. 8. £11 5*s.*

## Ex. 86.

1. $\frac{1}{3}$; $1\frac{29}{158}$, $\frac{79}{1123}$. 2. £779 3*s.* 4*d.* 3. 512; £51 4*s.*
4. 53 for 1*s.* 10*d.*; 1*s.* 8*d.* 5. £400. 6. 20·9661... 7. 63, 84, 147.
8. A. and B., £2 9*s.* $0\frac{4}{7}$*d.*; C. and D., £1 10*s.*; E., £2 1*s.* $10\frac{9}{7}$*d.*

### Ex. 87.

1. $2\frac{5}{8}$, $2\frac{5}{16}$; $\frac{317}{560}$. 2. £10 15*s.*; $14\frac{1}{2}$. 3. £2600.
4. 2 oz. 5. 35·31... 6. $3\frac{3}{77}$, $10\frac{3}{7}$ days.
7. £$32\frac{64}{623}$ 8. £250 1*s.* 10·95*d.* nearly.

### Ex. 88.

1. 427716, $\frac{63}{160}$; 14769. 2. £36 5*s.* 0·8436*d.*; 8. 3. 432.
4. $\frac{15}{16}$; $\frac{6}{7}$. 5. £500, £1000, £2000. 6. 240 ounces.
7. 10 and 4. 8. £5067 18*s.* $6\frac{3}{4}$*d.*; £3040 15*s.* $1\frac{13}{20}$*d.*; £2027 3*s.* $5\frac{1}{10}$*d.*
(sum is really £10135 17*s.* $1\frac{1}{2}\frac{1207238}{3048831}$*d.*).

### Ex. 89.

1. $146\frac{1}{2}$; ·2$\dot{4}$; 9·92$\dot{8}$. 2. £3800. 3. 32′ $43\frac{7}{11}$″ past 12.
4. £130. 5. 3 hr. 6. 35·774.
7. 2·5, 5, 12·5, 25, 2·08$\dot{3}$. 8. 40.

### Ex. 90.

1. £421 4*s.* $3\frac{7}{9}$*d.*; £14 11*s.* $2\frac{488}{648}$*d.* 2. 5 c. 3 qr. 1 lb. 3. £4488 15*s.*
4. 625. 5. £5020. 6. £5825 8*s.* $5\frac{1}{4}$*d.*
7. 26·32148. 8. £1 = 25 fr. 57 cent. nearly.

### Ex. 91.

2. 23 nearly. 3. $2\frac{53}{88}$; $\frac{9}{560}$. 4. 18. 5. $\frac{1219}{495}$; $\frac{1}{256}$; ·00390625.
6. £574 2*s.* $8\frac{1}{4}$*d.* 7. ·9354; 4968. 8. £183 3*s.* $2\frac{1}{2}$*d.*
9. $91\frac{3}{7}$. 10. $3\frac{1}{4}$. 11. £3 2*s.* $4\frac{76}{113}$*d.*
12. 65. 13. 13 ft. 6 in. 14. 10 gal. 1 qt. $0\frac{3}{8}$ pt.
15. £60 5*s.* 16. £15, £54, £111.

### Ex. 92.

1. $9111\frac{163746}{219581}$. 2. 15 yr. 3 mth. 1 wk. 4 dy. 13 hr. 20 min.
3. $256\frac{192}{385}$; 173. 4. 21. 5. 55 dy. 9 hr. 14′ 15″.
6. 15 years; 10 years. 7. £1470 15*s.* 8. £4 7*s.* $2\frac{1}{2}$*d.*; 480.
9. £159 18*s.* $5\frac{3}{17}$*d.* 10. 2*s.* $7\frac{5}{36}$*d.* 11. 11 months.
12. 36 ac. 3 rd. $38\frac{23}{25}$ poles. 13. £$206\frac{8}{45}$.
14. $\frac{1}{32}$; ·03125. 15. 2483. 16. $1\frac{1}{3}$ mile; 2 hr.

### Ex. 93.

1. 185841840. 2. $112\frac{1}{2}$ miles nearly. 3. $27\frac{5}{8}$ oz.
4. $\frac{102}{1564}$; $\frac{17}{261}$; 4*s.* $9\frac{1}{4}$*d.* 5. 1 dwt. $18\frac{1}{2}$ gr. 6. 146625.

1. 200 : 9; ·138. 8. 8*s.* $11\frac{11}{187}d.$ 9. £18 15*s.*; £31 5*s.*; £50.
2. $33\frac{1}{3}$. 11. ·447; ·584. 12. 3; 6; 9. 13. $5\frac{7}{9}$; $\sqrt{11}$.
3. 4200. 15. 1457 fr. $62\frac{1}{2}$ cnt. 16. £80 7*s.* 1*d.*; $183\frac{3}{4}$ days.

## Ex. 94.

2. 2 ft. $7\frac{1}{2}$ in. 3. 240; 720; 960. 4. $\frac{3}{13}$; $429\frac{48}{133}$.
5. 94 gal. 3 qt. $0\frac{4}{7}$ pt. 6. 1369. 7. £56 1 f. 6 c. 3 m.
8. 2·89036; 17*s.* $4\frac{8}{9}d.$ 9. 10. 10. 9009; 1. 11. 5 ft. 9 in.
12. 11*s.* 6*d.* 13. £269 2*s.* 0·375*d.* 14. 100.
15. $6\frac{18}{133}d.$ 16. £3 8*s.* 4*d.*; £4 8*s.* 4*d.*; £5; £5 11*s.* $2\frac{2}{3}d.$

## Ex. 95.

1. £4 11*s.* $8\frac{3}{4}d.$; £372 1*s.* $1\frac{3}{4}d.$ 2. 4680; 13 d. 15 h. 27′ 5″.
3. 9 hr. $10\frac{4}{7}$ min.; $\frac{2}{3}$. 4. £105; $20\frac{47}{108}$. 5. £79 10*s.*
6. 6*s.* $8\frac{40}{47}d.$ 7. 87·5; 1050. 8. 9.
9. 11·626; 506·25. 10. 7·07106.
11. 213, 355, 497; 525, 315, 225. 12. £2 7*s.* 10*d.* 13. 8 chains.
14. 2893 ft. $100\frac{5}{8}$ in. 15. Neither. 16. £264 12*s.*

## Ex. 96.

1. 50055050; 6864063. 2. 2320; 24 yd. 7 ft. 3 in.; 38141.
3. £5 16*s.* 8*d.* 4. $12\frac{1}{4}$. 5. 27720; 186. 6. 2625 guineas.
7. $\frac{13068}{33350}$. 8. $\frac{1}{15}$; $\frac{1}{1153}$. 9. $1081\frac{3}{37}$. 10. 5 yrs.
11. £13 12*s.* $8\frac{8}{11}d.$; £13 7*s.* $3\frac{3}{11}d.$ 12. £20 1*s.* $7\frac{17}{30}d.$ 13. £5000.
14. 54; 1620; 94 yds. 15. £2827 10*s.*; 91. 16. 1 : 4.

## Ex. 97.

1. MDCCXI. 2. 168; 180. 3. $7876\frac{1}{2}$; 640. 4. $99\frac{1}{2}$; 1.
5. The first recurs. 6. 44 days. 7. 34° 35′ and 165° 18′.
8. 18 ft. $3\frac{6}{25}$ in. 9. 5 ft. 579 in. 10. 4*s.* $9\frac{1}{2}d.$
11. £248; 4. 12. 6·14; 1·228. 13. 4, 4, 8.
14. 15. 15. £2106. 16. 66.

## Ex. 98.

2. 3254; 2645685. 3. £1044. 4. 19025 y. 319 d. 5 h. 20 m.
5. £231 8*s.* 6. 750·27807; £18 1*s.* $7\frac{1}{2}d.$ 7. $4\frac{7}{12}$. 8. $1\frac{7}{11}$; $4\frac{1}{3}$; $\frac{3}{385}$.
9. 40. 10. £2 5*s.* 11. 4*s.* 6*d.*; 4*s.* $10\frac{1}{2}d.$
12. 5 years; £545. 13. £61 10*s.*; £41. 14. $2\frac{1}{4}$ ft.
15. 100000; 5 acr. 1 rd. 21 pl. nearly. 16. £6 15*s.*

## Ex. 99.

2. 5 dwt. $3\frac{3}{4}$ gr.; £10 15*s*. $11\frac{1}{2}d$. 3. £2 13*s*. 4*d*.
4. £6 0*s*. $3\frac{3}{4}d$.; 1 : 11. 5. £6 8*s*. 11*d*.; $3\frac{1}{2}$. 6. £244 13*s*.
7. $7\frac{1}{2}$; $1\frac{1}{2}$. 8. £1274 4*s*. $6\frac{3}{10}d$. 9. ·625; ·3125; 250; 750.
10. £64 4*s*.; $\frac{61}{99}\frac{18}{55}$. 11. 1296; 36; 3 ft. 4 in. 12. $86\frac{2}{3}$.
13. 62 ft. $36\frac{15}{16}$ in. 14. £9 7 fl. 7 c. 7 m.
15. £581; £427. 16. £5234 1*s*. $5\frac{13}{16}d$; £3489 7*s*. $7\frac{7}{8}d$.

## Ex. 100.

1. 100049. 2. £412; £294. 3. ·0471; ·15625; $25\cdot117$; $2\frac{37}{50}$.
4. $\frac{5}{8}$; 17; $299\frac{6}{11}$; 1·125. 5. 1·2649; 1·023; ·17; ·012.
6. $137\frac{1}{7}$ ft. 7. $7\frac{49}{55}d$. 8. £1030 6*s*. $0\frac{6}{55}d$.
9. £264 5*s*. 10. £306 11*s*. 3*d*. 11. 22 fl. 7 c. 5 m.; 7*s*. $1\frac{1}{3}d$.
12. £18630. 13. 27°·5; 81°·5.
14. $7908\frac{103}{121}$ miles. 15. £647 10*s*. 16. 1 hour.

## Ex. 101.

1. 42414. 2. 73; 111. 3. £464427 1*s*. 8*d*; £69983 15*s*.
4. £136 15*s*. 4*d*.; £429 3*s*. $1\frac{1}{2}d$. 5. 9*s*. $8\frac{1}{2}d$.; £58 13*s*. 3*d*.
6. £61 18*s*. 5*d*. 7. £6 15*s*. 6*d*.; £2 5*s*. 2*d*.
8. £395 19*s*. 2*d*.; £11614 11*s*. 8*d*. 9. $55\frac{1}{2}$; 2·12; 4 ft. 4 in.
10. 17 years; £422 16*s*. 0·491835*d*. 11. £116 14*s*.; more.
12. $2\frac{4}{13}$; 73828·125. 13. ·0890625; $5\frac{2319}{4070}$.
14. $4\frac{7}{8}$ months. 15. £37 0*s*. $0\frac{3}{4}d$.

## Ex. 102.

1. 5497 ; 24 times. 2. 74 ton. 8 cwt. 10 lb. $10\frac{3}{5}$ oz.
3. 262 a. 1 r. 33 p.; 41. 4. 108. 5. 51 ; $\frac{69}{400}$; $\frac{47}{56}$.
6. $\frac{31}{5000}$; $\frac{153}{710}$; $2\frac{11}{12}$; $\frac{4}{125}$. 7. 3 qrs. 15 lb. ; $\sqrt[3]{3}$.
8. 1984 : 139 ; 20. 9. 19*s*. $5\frac{1}{3}d$. 10. £1 17*s*. 6*d*.
11. $6\frac{56}{99}$ days. 12. 7 yrs. $160\frac{55}{189}$ days.
13. £13611; £25722. 14. 7. 16. A. 5 times, B. 6 times.

## Ex. 103.

1. $122\frac{19929}{32359}$. 2. £2 5*s*. $11\frac{49765}{64796}d$.; 340635.
3. 30 gal. 3 qts. 1·968 pts.; $\frac{1}{288}$ ; 2 r. 4. £391; £529 ; £1311.
6. $\frac{4}{27}$ ; $\frac{61}{3640}$. 7. £17 4*s*. $10\frac{1}{2}d$. 8. £5 0*s*. $0\frac{1}{2}d$. ; 4*d*.
9. £203 16*s*. 2*d*. 10. ·029. 11. £546 0*s*. 3*d*.
12. £449 8*s*. $9\frac{15}{99}d$. 13. 4 ft. 1088 in.
14. 25 yards. 15. $11\frac{1}{3}$. 16. £3 15*s*.; £75.

## Ex. 104.

1. 29173173; 320790. 2. £128 12*s.*; 4800. 3. 256; 71680.
4. £10 7*s.* 6*d.*; 25. 5. $\frac{1}{81}$; $\frac{1627}{1305}$; $\frac{5}{8}$. 6. 30 days.
7. 1·56875; ·039675; 3210. 8. 14*s.* $4\frac{320}{21}$*d.* 9. 226.
10. £1 14*s.* $8\frac{44}{365}$*d.* 11. 61 ft. $2\frac{4}{17}$ in.; 44·3. 13. $17\frac{1}{11}$.
14. $\bar{1}$·36564. 15. 44. 16. last gains £49·16$\frac{19}{33}$*s.*

## Ex. 105.

1. 3321848284 2. 107310; 47 tons 14 cwt. 2 qrs. 17 lbs.
3. $5\frac{117}{145}$; $\frac{46}{385}$. 4. 1526·97916; $\frac{101}{825}$; $23\frac{318}{385}$; £18 2*s.* 3*d.* 5. 11*s.* 1*d.*
6. 81; £22 12*s.* $2\frac{1}{4}$*d.* 7. £1 3*s.* 5*d.*; 5*s.* $2\frac{3}{11}$*d.*
8. 24 y. 1 f. 59 in. 9. 203975; 41·1. 10. $22\frac{3}{5}$.
11. £1411 17*s.* 6*d.*; £5 12*s.* 6*d.* 12. 68°; 25°.
13 ·09531; ·46551. 14. 2 : 1. 16 $15\frac{33}{43}$.

## Ex. 106.

1. 3656. 2. 352. 3. 2 miles 330 yards; 41760.
4. £9 12*s.* $7\frac{1}{4}$*d.* 5. 7·98679; ·3125. 6. £49371; 17*s.* $6\frac{3}{4}$*d.*; 322500.
7. 1 cwt.; £2705 1*s.* 3*d.* 8. 225. 9. 25 ft. 4 in.
10. 2*s.* $7\frac{3}{25}$*d.* 11. £38 12*s.* 11*d.* 12. $3\frac{1}{3}$; $97\frac{1}{2}$.
14. 149 miles nearly. 15. 2 inches from end; $7\frac{1}{2}$ lbs. 16. 98.

## Ex. 107.

1. 7 years 223 days. 2. $7760\frac{1448}{1333}$. 3. The former by $\frac{1}{36}$.
4. 12752; 173 lb. 7 oz. 6 dwt. 16 gr.; 4 lb. 3 oz. 20 gr.
6. 1·19; 446666·6; ·259; ·3571428; ·00375. 7. 6.
8. ·2685; $\frac{11}{819}$; 14 p. 2 y. 2 f. 5·376 in. 9. 8·6802; 2·6; 138 a. 3 r. 1 p.
10 £400. 11. $\frac{1}{125125}$ lb. Av. 13. 2 oz. 14. £26 9*s.* $7\frac{1}{2}$*d.*
15. £400. 16. £$242914\frac{248}{441}$.

## Ex. 108.

1. 3360; 160. 2. 25 N. $2\frac{118}{191}$ f.; 556. 4. $\frac{585}{1474}$; 1.
5. 17*s.* $6\frac{35}{67}$*d.* 6. 21 y. 2 f. 7. 253004·05; £1 1*s.* 6*d.*
8. ·2635; ·011. 9. 10. 10. 1, 2, 6, 4.
11. £28 16*s.* 8*d.* nearly. 12. £1 3*s.* 4*d.* 13. 9*s.*
14. $\frac{3}{4}\{4 \log. 15 + \log. 16 - 4\}$. 15. £1250. 16. 7*d.*; 17*d.*

## Ex. 109.

1. 102. 2. 10*s.* 1*d.*; 24. 3. $33\frac{1161}{13440}$; $\frac{3}{4}$.
4. 14 a. 2 r. 27 p. 13 y. 5. 11 ft.
6. £54 18*s.* $1\frac{1}{2}d.$; £114 16*s.* $9\frac{468}{480}d.$ 7. 50. 8. 17·22; £1 1*s.* $4\frac{1}{2}d.$
9. $8\frac{17}{308}$ months. 10. 202500. 12. £600. 13. $2\frac{1}{2}$.
14. 80. 15. £1 15*s.*; £2 1*s.* 8*d.*; 9*s.* 4*d.* 16. $77\frac{1}{20}$.

## Ex. 110.

1. 6272640; 19 h. 7 g. 1 q. 1 p. 2. £1063 11*s.*; £276 19*s.* $3\frac{3}{4}d.$
3. 3 a. 584 y. 4. $\frac{175}{183}$. 5. $5\frac{1}{2}$ yd.; $\frac{6}{40}$, $\frac{7}{40}$; $\frac{47}{120672}$.
6. 1 cwt.; 2. 8. 2·4; 1200; ·04083; ·06. 9. 6.
10. 14·433. 11. 4 f. 9·136... in. 12. $57\frac{41}{87}$, $40\frac{39}{87}$, $91\frac{83}{87}$, $10\frac{39}{87}$. 13. £12.
14. £1 18*s.* 6*d.* 15. $314\frac{1}{2}$. 16. 5·33, 3·52, 3·15 inches nearly.

## Ex. 111.

1. £96; $9\frac{3}{8}d.$ 2. 1103 f. 640 in.; £2 0*s.* $10\frac{94}{245}d.$ 3. $13\frac{1}{2}d.$
4. 87. 5. $\frac{249}{5000}$; 1543...; ·67361. 6. $\frac{21433}{71388} \times \frac{7402}{2705513}$.
7. 22 ft. 8. 3708·17; ·00129; 8*s.* 3*d.*; 4th, 5th, 2nd.
10. £639 17*s.* 0·44775*d.* 11. 18*s.* 4*d.* 12. 4·816. 13. $89\frac{11}{12}$.
14. £3375. 15. 25 fr. $35\frac{15}{23}$ cents. 16. £30; £4 10*s.*

## Ex. 112.

1. 513. 2. 30 Jan. 1649. 3. $\frac{289985520}{838859887}$; $\frac{3}{8}$; $\frac{120}{180}$, $\frac{135}{180}$, $\frac{144}{180}$, $\frac{100}{180}$.
4. $\frac{12}{35}$; 4 b. $2\frac{2}{7}$ p.; 2 miles. 5. ·0015625; 1 q. $1\frac{7}{11}$ p.
6. 37·1506...; 11° 15′. 7. 99·49... yards. 8. 2*s.* $10\frac{3}{4}d.$
9. ·94...; ·3. 10. £8 17*s.* $1\frac{1}{2}d.$ 11. 50. 12. 5044.
13. 248664*et*69; 5221. 14. 50 ft. 15. £1 10*s.* 1*d.* 16. 20 h. 50 m.

## Ex. 113.

1. 52 yds. 11 in.; 3 cwt. 2 qrs. 10 lbs. 2. 135; 119; 7776000.
3. $1000\frac{5}{8}$; $11\frac{11}{12}$; $\frac{11}{336}$. 4. $\frac{1}{6}$; $\frac{3}{10}$; 26 a. 20 p. 5. 1300; ·2197; ·0693.
6. 12 days. 7. 10101. 8. 9*s.* 6*d.*
9. 1080936581761; 108093658176; 9; the 13th. 10. 75 yards.
11. £720; £5000. 12. 1 ft. 3 in. 14. $12\frac{1}{2}$ gain.
15. £2 $9\frac{3}{77}$*s.* 16. $16\frac{1}{2}$.

## Ex. 114.

1. $9703\frac{11}{41}$. 2. 2*s.* 3*d.*; £11250. 3. 5 f. 7 c. 5 m.
4. ·525; £60 16*s.*; 3*s.* 5. $\frac{1}{3}$; $\frac{192}{195}$; $\frac{168}{195}$; $\frac{5}{35}$. 6. $\frac{9}{20}$; ·45; 1*s.* 6*d.*

7. 3. 8. £750. 10. 101 f. 56 in.
11. £1111 2s. $2\frac{1}{2}$d. 12. 23515302409. 13. £2 11s. 8d.
14. 11 p. m. 15. 100. 16. $\frac{18}{4713}$s.

## Ex. 115.

2. £2; 1792. 3. £33 8s. 9d. 4. 1. 5. $\frac{3}{10}$; $\frac{1}{8000}$; 13s. $6\frac{3}{4}$d.; $\frac{1813}{2861}$.
6. 1250; 125; ·00000125; 101·375; ·28; 4·0005.
7. $\frac{15}{56}$; $\frac{3}{7}$; $\frac{1}{350}$. 9. 64 : 63. 10. 3253. 11. 135 days.
12. 2; £1300. 13. Loses £5; £15.
14. 1 h. $21\frac{9}{11}$ m.; 1 h. $5\frac{4}{11}$ m.; 1 h. $38\frac{2}{11}$ m.
15. £963 11s. $9\frac{201}{1000}$d.; £466 15s. $1\frac{2171}{43649}$d. 16. $205\frac{1}{3}$, $29\frac{1}{3}$, 176 yards from the starting point.

## Ex. 116.

1. £69218 2s.; 17 cwt. 12 lbs. 2. $\frac{9}{91}$; $\frac{37}{55}$; $\frac{5}{4}$.
3. 7s. $10\frac{1}{2}$d; 23·125; $\frac{187}{200}$. 4. £1388$\frac{8}{9}$. 5. ·215; ·793.
6. The former. 7. 38; £4 7s. $9\frac{3}{7}$d. 8. £2; $\frac{1}{3}$.
9. ·0002938; ·001925; ·27. 11. £200. 12. $61\frac{29}{37}$.
13. £1389 3s. 14. £1350. 15. $1\frac{1}{3}$ h. 16. April 16.

## Ex. 117.

1. 2, 10, 14. 2. $1\frac{4}{13}$ h. 3. $33\frac{41}{53}$ m.
4. $144\frac{9}{10}$ ft. 5. 20000; 225000. 7. 9 h. 32 m.
8. £48 18s. 9. £1444$\frac{36}{731}$. 10. $\frac{1}{18}$.
11. 3s. $8\frac{1073}{1543}$d. 12. 3 h. 48 m. 13. $11\frac{691}{709}$s.
14. £4957 6s. 8d. 16. £3054 5s.
17. £1530; £360; £540; 630. 18. 357·79 ft. 19. 6 miles.
20. 6 h. 30 m.; 39 miles. 21. 171. 22. 3000.
23. £1002; £668; £334. 24. $\frac{1}{130000}$ sq. in. 25. 73.
26. $3\frac{8}{37}$; $13\frac{13}{37}$ days. 27. 7s. $6\frac{1}{2}$d.; 2s. $6\frac{1}{2}$d.
28. $\frac{1}{1000}$. 29. $\sqrt{10}$; 3·162. 30. 4; $7\frac{3}{8}$ ft.
31. £9 18s. $0\frac{24}{101}$d.; £10. 32. $112\frac{2}{9}$ yds. 33. $16\frac{1}{2}$ minutes.
34. 28·125 ft.; 7·68 inches. 35. $4\frac{7}{13}$ miles. 36. 5 ft. 6 in.
38. £5013 0s. 5d.; £1562 10s.; £13333 6s. 8d.; £4400.
39. 14s.; 11s. 40. 5·25 in. 41. 1872.
42. 30, 48, 72. 43. 3s. $4\frac{8}{15}$d. 44. £42 15s. $5\frac{5}{93}$d.
45. 405 lbs. 46. 2s. 4d. 47. £2030.
48. £23 17s. 4d. 49. 4 hours. 50. Loses £400.
51. $197916\frac{2}{3}$ miles. 52. 3 to $2\frac{2}{3}$. 53. £12 13s. 9d.
54. £1040. 55. 688 sq. ft. 56. £10,000.

57. 5 : 4. 58. $\frac{1}{\sqrt[3]{10}}$ ft. 59. $77\frac{7}{9}$; $1542\frac{2}{7}$; $3\frac{34}{47}$; £46 10*s.* $10\frac{10}{47}$*d.*
60. 48 days. 61. 150 yds.; 11250 sq. yds. 62. 12510 miles.
63. $21\frac{3707}{9133}$. 64. 1*s.* 6*d.*; 1*s.* 8*d.*; 1*s.* 3*d.*
65. $70780\frac{10}{11}$. 66. 14.
67. 1 a. 3 r. 31 p. $16\frac{1}{4}$ yds.; £447 16*s.* $8\frac{40}{131}$*d.* 68. £87 10*s.*
69. 15 miles; Wednesday. 70. £204 $10\frac{6}{11}$*s.*
71. £50 12*s.* 6*d.* 73. £37 6*s.* $3\frac{8}{20}$*d.*
74. 4 ft. 10 in. 75. $5\frac{1}{3}$ days, 16 days.
76. 8 millions. 77. $\frac{16}{27}$; 61 yds. 2 ft. 4 in.; 3·5584.
78. £2 1*s.* 8*d.*; £2 5*s.* 10*d.* 79. ·015625; ·367879; 4*s.* $1\frac{4}{55}$*d.*
80. 12 h. $35\frac{35}{719}$ m. 81. £1249 19*s.* $10\frac{18}{25}$*d.*
82. £3000. 83. 12 January; 21 July.
84. 189. 85. 24, 72.
86. 4; wall between 4 and 5 is opposite wall between 5 and 6, &c. &c.
87. $213\frac{127}{456}$; 3*s.* $3\frac{1}{8}$*d.*; $\frac{3}{8}$*d.*; 2nd, 3rd, 1st. 88. 56 lbs.
89. 47 : 80; $\frac{1573}{9180}$; £9 4*s.* $8\frac{1}{4}$*d.*; 1. 90. $26\frac{2}{15}$; $28\frac{4}{7}$.
91. 3 in.; 9·1 ft. 92. 104 guineas. 93. $3\frac{3}{4}$ h.

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